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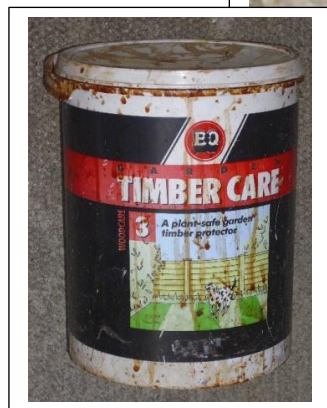
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Removing Hazardous Materials from Buildings

A Training Curriculum

Donna J. Schell, Stephen D. Cosper, Susan A. Drozd,
Thomas R. Napier, and Dominique S. Gilbert

March 2016



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Removing Hazardous Materials from Buildings

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Donna J. Schell, Stephen D. Cospers, Susan A. Drozd,
Thomas R. Napier, and Dominique S. Gilbert

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Final report

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Prepared for Office of the Assistant Chief of Staff for Installation Management (OACSIM)
 Facility Policy Division
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Under Project B11127, "Hazardous Building Material Training Curriculum
 Development"

Abstract

There has been little or no formalized training available within the Army for installation personnel to appropriately identify, handle, and dispose of hazardous materials generated during the renovation and/or demolition of Army buildings. As the Army's new construction programs wind down, attention must be paid to operation, repair, and renovation of existing facilities—where hazardous materials are more likely to be encountered. An ad hoc, reactive approach to dealing with hazardous materials will adversely impact repair, renovation, and operation budgets and schedules while increasing the likelihood of regulatory noncompliance. Development of a training regimen was previously deferred but is now being addressed. Per direction from the Office of the Assistant Chief of Staff for Installation Management Facility Policy Division (DAIM-ODF), a Public Works Technical Bulletin, "Toxics Management," was completed in 2014 and published through Headquarters, U.S. Army Corps of Engineers. That publication provides guidance to address specific toxic and hazardous materials associated with buildings that are owned, leased, or otherwise controlled by the Department of the Army. For additional training documentation, this report captures a workshop-style training curriculum developed to enable installation operations and management personnel to identify, handle, and dispose of hazardous building materials in a safe, thorough, efficient, compliant, and economical manner.

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Preface

This study was conducted for the Office of the Assistant Chief of Staff for Installation Management (OACSIM) Facility Policy Division under project number B11127. Funding was provided by Customer Order Number 10258947, “Hazardous Building Material Training Curriculum Development,” dated 26 June, 2013. The Technical Monitor was Ms. Liisa White, DAIM-ODF.

The work was performed by the Engineering Processes Branch (CFN) and Materials and Structures Branch (CFM) of the Facilities Division (CF) and the Ecological Processes Branch (CNN) and Environmental Processes Branch (CNE) of the Installation Division (CN), U.S. Army Engineer Research and Development Center–Construction Engineering Research Laboratory (ERDC-CERL). At the time of publication, Ms. Vicki VanBlaricum was Chief, CEERD-CFM; Mr. Charles G. Schroeder was Chief, CEERD-CFN; Mr. Garth Anderson was Chief, CEERD-CNE; Mr. Chris Rewerts was Chief, CEERD-CNN; Mr. Donald K. Hicks was Chief, CEERD-CF; and Ms. Michelle Hanson was Chief, CEERD-CN. The Deputy Director of ERDC-CERL was Dr. Kirankumar Topudurti, and the Director was Dr. Ilker Adiguzel.

COL Bryan S. Green was the Commander of ERDC, and Dr. David W. Pitman was the Director.

Unit Conversion Factors

Multiply	By	To Obtain
cubic feet	0.02831685	cubic meters
cubic yards	0.7645549	cubic meters
degrees (angle)	0.01745329	radians
degrees Fahrenheit	(F-32)/1.8	degrees Celsius
feet	0.3048	meters
inches	0.0254	meters
ounces (U.S. fluid)	2.957353 E-05	cubic meters
pounds (mass)	0.45359237	kilograms
square feet	0.09290304	square meters
square inches	6.4516 E-04	square meters
yards	0.9144	meters

Abbreviations

Term	Meaning
ACA	ammoniacal copper arsenate
ACC	acid copper chromate
ACM	asbestos-containing materials
ACQ	alkaline copper quaternary
ACZA	ammoniacal copper zinc arsenate
AHERA	Asbestos Hazard Emergency Response Act
AIA	Asbestos Information Act
Al	aluminum
AR	Army Regulation
ASTM	American Society of Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
Au	copper
AWPA	American Wood Protection Association
BIM	building information modeling
BIMS	building information management system
BRAC	base realignment and closure
CCA	chromated copper arsenate
C&D	construction and demolition
CDC	Centers for Disease Control and Prevention
CEGS	Corps of Engineers Guide Specification
CFR	Code of Federal Regulations
CLIN	contract line item number
CO	Contracting Officer
COR	Contracting Officer Representative
CP	competent person
CPSC	Consumer Product Safety Commission
CPSIA	Consumer Product Safety Improvement Act
CSI	Chemical Specialties Inc.
DA	Department of the Army
DA PAM	Department of the Army Pamphlet
DAIM-ODF	OACSIM Facility Policy Division
DHHS	Department of Health and Human Services
DoD	Department of Defense
DoDD	Department of Defense Dependents (school)
DOE	Department of Energy
DOT	Department of Transportation

Term	Meaning
DPW	Directorate of Public Works
EP	Engineering Pamphlet
EPA	U.S. Environmental Protection Agency
ERDC-CERL	Engineer Research and Development Center-Construction Engineering Research Laboratory
ERP	enterprise resource planning
FAR	Federal Acquisition Regulations
f/cc	fibers per cubic centimeter
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FRP	Facilities Reduction Program
GFEBs	General Fund Enterprise Business Systems
HUD	Department of Housing and Urban Development
HEPA	High Efficiency Particulate Air
HQUSACE	Headquarters, U.S. Army Corps of Engineers
IMCOM	Installation Management Command
IRIS	Integrated Risk Information System (EPA)
LBP	lead-based paint
MCA	Military Construction, Army
MCL	maximum contaminant level
MFL	million fibers per liter
MICC	Mission and Installation Contracting Command
MILCON	military construction (Army)
MSDS	material safety data sheet
MSWLF	Municipal solid waste landfill
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLLAP	National Lead Laboratory Accreditation Program
NVLAP	National Voluntary Laboratory Accreditation Program
O&M	operations and maintenance
OACSIM	Office of Assistant Chief of Staff for Installation Management
OMA	Operation and Maintenance, Army
OPLAN	operations plans
OSHA	Occupational Safety and Health Administration
PACM	presumed asbestos-containing material
PAM	pamphlet (Army publication)
PAO	Public Affairs Office

Term	Meaning
Pb	lead
PCB	polychlorinated biphenyl
PCM	phase contrast microscopy
PEL	permissible exposure limit
PLM	polarized light microscopy
PPE	personal protective equipment
ppm	parts per million
PPS	Project Prioritization System
PRIDE	Planning Resources for Infrastructure Development and Evaluation
PWL	paint with lead (Army)
PWTB	Public Works Technical Bulletin
QA	quality assurance
QC	quality control
RACM	regulated asbestos-containing material
RCRA	Resource Conservation and Recovery Act
RoC	Report on Carcinogens
RRP	Renovation, Repair and Painting (Rule)
SDWA	Safe Drinking Water Act
SEP	Special Emphasis Program
SiO ₂	silica
SME	subject matter expert
SOP	standard operating procedures
SRM	Sustainment, Restoration, and Modernization (Army)
SW	solid waste
TCLP	toxicity-characteristic leaching procedure
TEM	transmission electron microscopy
TM	Technical Manual
TMP	Toxics Management Plan
TMT	Toxics Management Team
TSCA	Toxic Substances Control Act
TSD	treatment, storage, or disposal
TWA	Time-weighted average
UFGS	United Facility Guide Specification
UL	Underwriters Laboratory
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
UV	ultraviolet

Term	Meaning
UW	Universal waste
VOC	volatile organic compound
WWII	World War II
XRF	x-ray fluorescence

1 Introduction

1.1 Background

There has been little or no training available within the Army for installation personnel to appropriately identify, handle, and dispose of hazardous materials in Army buildings. As the Army's recent new construction programs wind down, attention must be paid to operation, repair, and renovation of existing facilities—facilities where hazardous materials are more likely to be encountered. An ad hoc, reactive approach to dealing with hazardous materials will adversely impact repair, renovation, and operation budgets and schedules while increasing the likelihood of regulatory non-compliance. Development of a training regimen has been previously deferred but is now being addressed.

As the Army began looking at doing more repurposing of existing buildings and/or actual demolition of buildings, the Office of Assistant Chief of Staff for Installation Management (OACSIM) became aware of the need for guidance on how installations are expected to handle the hazards they encounter when performing repurposing or demolition.

In 2014, the OACSIM Facility Policy Division (DAIM-ODF) completed a Public Works Technical Bulletin (PWTB) titled *Toxics Management* that was published through Headquarters, U.S. Army Corps of Engineers (HQUSACE). PWTB 200-1-144 provides guidance to address specific toxic and hazardous materials associated with buildings that are owned, leased, or otherwise controlled by the Department of the Army (DA). Its guidance is directed toward installations' Directorate of Public Works (DPWs) and other engineering activities that operate and maintain Army facilities.

The training curriculum captured in this report was initiated as an additional vehicle that could provide a capability to Army personnel and offices when managing hazardous materials in buildings.

1.2 Objective

A workshop-style training curriculum was developed to enable installation operations and management personnel to identify, handle, and dispose of hazardous building materials in a safe, thorough, efficient, compliant, and

economical manner. Doing so will support OACSIM in matters regarding hazardous building materials and in providing ongoing training.

1.3 Approach

Intended workshop audiences were identified by considering the potential attendees' job responsibilities and how the curriculum should be relevant to those responsibilities. Existing practices, existing knowledge levels, gaps in knowledge or skills, and information necessary to fill those gaps were identified. It was assumed that workshop attendees will be DPW staff who are involved primarily in initiating and overseeing contracts, since the work of surveying, removing, handling, and disposing of hazardous building materials is typically accomplished by a contractor.

The scope of the hazardous building materials to be addressed and the scenarios under which hazardous building materials are encountered was confirmed with the sponsor. Materials of interest included asbestos, lead-based paint (LBP), polychlorinated biphenyls (PCBs), heavy metals, silica, treated wood, other problematic wastes, and solid waste. Because hazardous building materials removal is almost always conducted on a contract basis, the subject of contracting was also included in the scope of this training curriculum.

The scope and content of the curriculum and the format of workshops was confirmed with the sponsor. Issues addressed included instructional resources, workshop materials and aids, instructor personnel, workshop duration, and level of instruction and information detail. A syllabus for the curriculum and workshops was developed and confirmed with the sponsor.

The workshop's content (i.e., the curriculum) was developed by personnel from the Engineer Research and Development Center-Construction Engineering Research Laboratory (ERDC-CERL), and each team member relied on their own network of experts and resources for input and review. Emphasis was placed on the knowledge or capability gaps identified for potential attendees, as opposed to repeating information which would already be common knowledge and common practice in Army DPW offices. Curriculum content included: regulatory requirements, where and how hazardous building materials may be encountered at each building's life-cycle stage, hazardous building materials recognition, surveying, safety, abatement, and handling and disposal practices. It was agreed with the

project sponsor that this curriculum would not be intended to provide either advanced training or certification training for identifying or handling hazardous building materials, as is required by the Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA) or other regulatory authorities.

A master set of workshop materials was produced. The set includes presentation materials, an instructor's manual, student handouts, pre- and post-tests, supplementary exercises, workshop evaluation, and certificate of completion (see various appendices of this report). All materials were developed to be applied directly to workshops. Some class-specific input will be required on a class-by-class basis. All content can be customized per the preferences of the instructors.

All of the pertinent, basic curriculum visual materials are reproduced in this report,¹ and speaker notes (edited for clarity) are included as the text of this report. Note that due to not reproducing all slides from the curriculum in this report, the numbers appearing at the bottom right corner of slide reproductions are not in full sequential order.

1.4 Mode of technology transfer

This curriculum package will be used for workshops conducted by DAIM-ODF.

¹ For example, title slides have been omitted from the materials reproduced in this report to avoid redundancy and excessive length.

2 Hazardous Building Materials Overview

2.1 Learning objectives

In this training curriculum, Army personnel will gain knowledge to be able to perform the following tasks or areas of learning:

- Identify hazardous building materials, understand why they are a concern, and learn where they are likely to exist at Army installations and facilities.
- Identify and understand the impacts of laws, regulations, and standards applicable to hazardous building materials.
- Learn practices, tasks, and control measures involved in removing hazardous building materials, including Army guidance.
- Become familiar with the contents and applications of contracts to remove hazardous building materials.


At the conclusion of this course, students should be able to perform the following tasks:

- Identify building materials that can expose a building's occupants to a hazard or create an occupational hazard to building tradespersons.
- Identify and apply the laws, regulations, and standards governing the detection, identification, removal, storage, and disposal of each identified hazardous building material.
- Describe the practices, tasks, and control measures involved with removing each of the identified hazardous building materials from buildings in a safe and complete fashion. This task includes identifying specific criteria governing the performance of these tasks.
- Describe the basic contents of a contract for services to remove hazardous building materials; describe how the contract is applied to the design, acquisition of services, and execution of a project to remove hazardous building materials from a building.

Specific materials and important related topics covered by the curriculum are arranged in subsequent chapters of this report.

2.2 Definitions

Care must be taken when using the word “hazardous,” because it is a term that has common use connotations as well as regulatory implications.



What Are Hazardous Materials?

- In general, hazardous materials have the potential to:
 - Damage human health and safety
 - Damage environmental systems through releases to the air, water, or soil
- Certain materials are defined as “hazardous” by US EPA.
- Other materials may present a hazard, even though they are not explicitly defined as “hazardous.”
- Specific definitions and regulations will be discussed within topic sections about individual hazardous building materials

Removing Hazardous Materials from Buildings

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While the EPA does define the term “hazardous materials” and its synonym “hazardous substances,” unfortunately the EPA is not entirely consistent in how it defines the phrase. When reviewing the definitions found in 40 CFR 261.31, 40 CFR 261.32, and 40 CFR 261.33, it will be evident that there are subtle differences between the definitions in each of these regulations.

The EPA also has adopted other terminology to categorize specific waste streams such as PCBs, asbestos, and LBP. Specific definitions, regulations, and regulatory sources will be given in the discussion of each hazardous building material included in this course.

OSHA also uses the term “hazardous” within its regulations, but it also does not define the term explicitly. Instead, the OSHA approach is to identify, substance by substance, the associated exposure issues. These substance-specific issues also will be discussed in later sections of this course.

The term “material” is used instead of “waste” in this course. The phrase “hazardous waste” has very specific regulatory meaning, and it is the authors’ hope that not all of the materials resulting from repurposing or demolishing a building will actually end up as waste.




What Are Hazardous Materials?

- In the context of buildings, hazardous materials are:
 - Materials that were at one time permissible, but have since been listed by US EPA, or otherwise identified as creating an environmental and/or human health hazard when deteriorated or disturbed, or when entering the waste stream.
 - Examples can be found in:
 - Materials that were part of the original construction
 - Materials that were added to the building when repurposing
 - Materials that have been contaminated by other applied substances.


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As well known, it is not uncommon for humans to identify a substance, tool, or product as the best thing ever to come along for a particular purpose only to find out later that the substance, tool, or product may contain properties that are dangerous to human health or, when sent for disposal, that are dangerous to the environment.



What Are Hazardous Materials?


- In the context of buildings, hazardous materials are also those which create potential negative human health exposures :
 - During occupancy
 - Upon removal
 - In transport
 - From disposal, landfill behavior



Buildings at Fort Bragg, NC


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Asbestos and LBP are among those materials causing the most common exposure problems.






What Are Hazardous Materials?

- Is a hazardous material always a hazardous waste?




 - Federal regulations have specifically defined the parameters for hazardous waste. (40 CFR 260)
 - Federal regulations have also defined parameters for the following types of waste outside of the definition for hazardous waste:
 - Universal waste
 - Asbestos-containing material
 - PCB waste
 - Construction and demolition (C&D) debris
 - Non-hazardous solid waste

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Often there is a belief that if something starts out as a “hazardous material,” it must end up as a hazardous waste. Title 40 of the Code of Federal Regulations (CFR), Part 260 goes into excruciating detail about what makes a waste a hazardous waste. Since that is an entirely separate 40-hour course, the exhaustive details as to what is a hazardous waste will not be covered here. However, this curriculum will advise on when the specific materials talked about (see next graphic) are considered actual hazardous waste and when they are categorized as something entirely different.




What Are Hazardous Materials?

- This course will specifically address the following hazardous building materials:
 - Asbestos and asbestos-containing materials
 - Lead-based paint
 - Heavy metals (including lead and mercury)
 - Polychlorinated biphenyls (PCBs)
 - Molds
 - Treated lumber
 - Silica
 - Other problematic waste materials

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2.3 Concerns of improper handling

**Why Are Hazardous Building Materials a Concern?**


- Potential harm to human health:
 - Respiratory systems
 - Nervous systems
- Potential to harm the environment
 - Groundwater contamination from incorrect disposal of contaminated items
 - Stormwater runoff from improperly stored building materials contaminating waterways

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No one wants to intentionally harm another individual's health or harm the environment in the process of renovating or demolishing a building or multiple buildings. However, there are well-documented, classic examples of inadvertent harm to human health, as shown by well-documented cases such as the following:

- Asbestosis compromising respiratory systems.
- Lead exposures damaging nervous systems.
- Disposal of PCB-containing ballasts and capacitors in a landfill that is not equipped with the necessary liners or structure to prevent PCBs from leaching into the area groundwater.
- Stormwater runoff from the piles of treated lumber that can damage aquatic life.

In some cases, more incentive is needed to take the extra steps in handling these materials properly, which is where legal incentives can provide motivation.



Why Are Hazardous Building Materials a Concern?

- Avoiding fees/fines from:
 - Clean Air Act
 - Safe Drinking Water Act
 - Resource Conservation and Recovery Act (RCRA), Subtitle C
 - RCRA, Subtitle I
- Avoiding jail
- Avoiding shutdown of operations

(Subsequent slides provide examples.)

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Federal facilities can be fined for environmental violations under portions of the Clean Air Act, the Safe Drinking Water Action, the Resource Conservation and Recovery Act (RCRA) Subtitle C, which addresses hazardous waste, and RCRA Subtitle I, which addresses underground storage tanks.

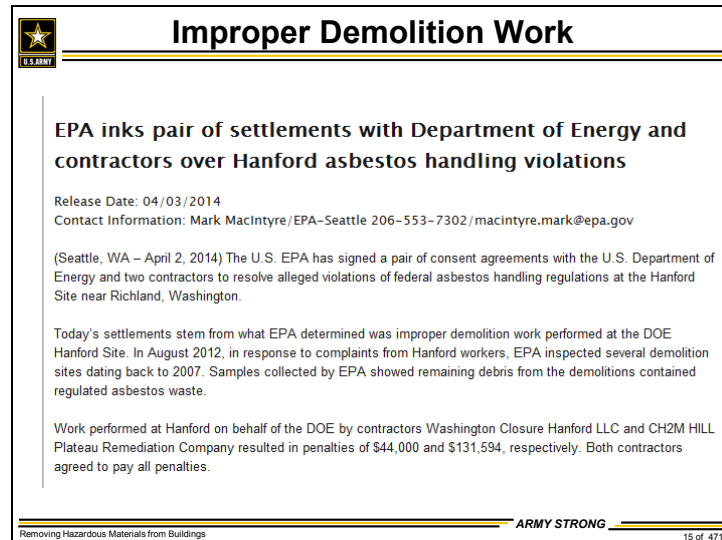
In regard to specific materials discussed in this curriculum, asbestos is regulated under the Clean Air Act; and lead, mercury, and other hazardous wastes are regulated under RCRA, Subtitle C. RCRA Subtitle I applies when renovation or demolition of a structure involves removal of an underground storage tank. Thus, there are indeed renovation or demolition situations which are subject to fees or fines under federal and state regulations.

In regard to potential jail time for violations, the baseline for criminal prosecution for environmental crimes is the phrase “willingly and knowingly.” If it can be proven you knew not to store the PCB-contaminated waste out in an open field while waiting for disposal and you authorized it anyway, that action could be construed as “willingly and knowingly.”

Operational shutdown is the “ace in the hole” for regulatory agencies. Typically, a shutdown occurs only when the regulator feels there is no other option, the facility or installation is not being receptive to an agency’s requests, and/or there is no financial liability involved for the installation. Probably the most famous case relates to the red-cockaded woodpecker. In 1990, the U.S. Fish and Wildlife Service issued a “jeopardy biological opinion,” requiring Fort Bragg to take action to recover its woodpecker population or else face sharp restrictions on military training activities. After

extensive research, however, it turned out that military training at Fort Bragg did not cause the decline in the woodpecker population; the cause was bad forestry management.

2.3.1 Improper demolition work



The example outlined above is one for which a federal facility was liable for (and could be fined for) the actions of its contractors.

While the actual language used in the contract is unknown, it would be surprising if it did not contain the common phrase “in accordance with all safety and environmental regulations” or something similar. So, there are questions about how well the contract stipulations were enforced.

In particular, the EPA’s inspection found the following violations:

- Department of Energy (DOE) and their contractors failed to remove more than 100,000 square feet of asbestos prior to demolishing buildings and structures, as required by federal law.
- DOE and their contractors provided incomplete or inaccurate notifications to EPA or the local air agency (Benton Clean Air Authority) while the demolition projects were underway.
- Inspection of a waste storage trailer showed that some wastes were not properly contained in leak-tight containers.

How do these settlement agreements actually get paid? In the Department of Defense (DoD), payments typically come from the budget of the installation where the problem happened.

2.3.2 Improper handling of lead-based paint (LBP)




The screenshot shows a webpage with a U.S. Army logo in the top left corner. The main heading is "Improper LBP Work". Below this is a sub-heading "Lead Renovation, Repair and Painting Rule – May 02, 2013". The text states: "(Washington, DC - May 2, 2013) – The U.S. Environmental Protection Agency (EPA) today announced 17 enforcement actions for violations of the lead-based paint Renovation, Repair and Painting Rule (RRP). A priority for EPA's enforcement program is to protect children, and others, from exposure to lead dust that can cause lead poisoning by ensuring that renovators follow the RRP and other lead rules." To the right of this text is a green box labeled "Settlements Resources" containing a link "Press Release". Below the main text, it says "On this page:" followed by a list of links: "CM Rogers Handyman", "New Hampshire Plate Glass", "Reeson Construction", "Accolade Construction", "Creative Renovations", "PZ Painting", "Cherokee Home Improvements, LLC", "EA Construction", "Roman Builders", "Window World", "Camaj Interior & Exterior", "Henderson & Associates Services, LLC", "Home Resources Management, LLC", "ARK Property Investments", "Midwest College Painters", "Albracht PermaSiding and Window Co.", and "Groeller Painting Inc.". At the bottom, there is a link "Contact Information". The footer of the page includes "Removing Hazardous Materials from Buildings", "ARMY STRONG", and "16 of 471".

The above example is just one which highlights the EPA's crack down on the LBP renovation and repair business. The violations are very similar to those found in relation to asbestos: personnel were not adequately trained, improper protective equipment was used, and waste was disposed of incorrectly.


While federal facilities are not yet subject to fee or fine under this particular LBP Rule, they are subject to fee or fine under the hazardous waste regulations. So, if the LBP-contaminated waste ends up being disposed of incorrectly, the necessary samples to determine hazards were not taken, or the paperwork documentation of where the waste went was not correct, there could be a fine under RCRA Subtitle C.

2.3.3 Improper handling of polychlorinated biphenyls (PCBs)



Improper PCB Handling

- Do not see many publicized enforcement actions in either the public or the private sector related to PCBs, but:
 - DoD is being held liable for cleanup sites with PCBs contamination.



Lualualei Superfund Site,
Hawaii


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Two of the most well-known military EPA Superfund sites with PCB contamination are the Wahiawa and Lualualei Superfund sites in Hawaii. Under a 2009 Federal Facility Agreement, the Navy will work with the EPA and the state to address any remaining issues at the Naval Computer and Telecommunications Area Master Station Pacific in central Oahu and the Navy Radio Transmitter Facility at Lualualei near the Navy Munitions Command base in Leeward, Oahu. Cleanup actions have primarily been focused on soil from former PCB transformer sites.

2.3.4 Consequences of improper handling



Improper Hazardous Waste Handling

Joint Base Elmendorf-Richardson settles with EPA for hazardous waste law violations

Release Date: 09/18/2013
Contact Information: Hanady Kader, EPA Public Affairs, 206-553-0454, kader.hanady@epa.gov

(Seattle—Sept 18, 2013) Joint Base Elmendorf-Richardson in Anchorage failed to comply with federal hazardous waste management laws and has agreed to pay a fine to resolve the violations, according to a settlement with the U.S. Environmental Protection Agency. The base has taken action to correct the violations and will pay a fine of over \$21,000.

“Careful hazardous waste management protects human lives and the environment, and it also prevents the public from having to fund costly cleanup operations,” said Scott Downey, Manager of the Hazardous Waste Compliance Unit at the EPA Seattle office. “Facilities have to inspect hazardous waste storage and keep staff up to date on training to prevent incidents.”

The facility generates and stores hazardous waste from vehicles, aircraft and other facility maintenance. This includes acids, contaminated soils, batteries, PCB wastes, solvents, used oil and pesticides.

EPA inspections found a series of violations from 2010-2011, including failure to conduct weekly inspections of hazardous waste facilities and containers for leakage or deterioration; failure to ensure staff participated in annual hazardous waste management training; and failure to submit hazardous waste tracking reports.

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Hazardous waste violations are probably the most common types of environmental compliance violations found at federal facilities. They are also probably the most looked-for violations by regulators because of the associated fines.

The key point relating to repurposing or demolition is to know what waste streams are going to be involved and whether any of them have the potential to be classed as hazardous waste. If there are repurposing or demolition wastes with the potential to be categorized as hazardous waste, personnel involved should work with personnel who are handling hazardous waste at the installation BEFORE starting the repurposing/demolition project. This coordination should ensure there are no inadvertent violations of the regulations resulting from incorrectly labeling, storing, or handling the hazardous waste.

2.4 Hazardous building materials at Army installations and facilities

**Hazardous Building Materials At Army Facilities**


- Ideally, hazardous and toxic materials should not be present in buildings, however ...
 - Older buildings may still have them.
 - Sometimes they were installed during construction or renovation prior to the discovery of hazardous or toxic properties.
 - Abatement may have been performed ... but maybe not.
 - Some hazardous materials are still found in contemporary building materials.

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In a perfect world, hazardous building materials in occupied buildings—either on-post or off-post—would never be a concern. However, reality is that these materials *have* been incorporated into building construction over the decades. This incorporation happened because certain materials were considered to be “wonder materials” in their day. Human knowledge then did not include their hazardous properties. The state of earlier science was either incapable of identifying hazards, or no one thought to look for hazards at that time. Thus, lack of knowledge and future consequences ended up hurting both humans and the environment.

Thus, older buildings are more likely to contain hazardous materials. The hazardous building materials may have been installed as part of the original construction, or they may have been added through the years. Remediation or abatement may have been performed through the years; however, this type of action cannot be assumed without some explicit, definitive evidence to that effect.

Conventional wisdom suggests that buildings built before the early 1980s are likely to contain hazardous building materials, and those built after the early 1980s are not. This timeline also serves as a convenient chronological indicator of what constitutes an “older” building. However, this timeline indicator is not absolute. Some contemporary building materials can contain materials considered hazardous. For example, some roofing felts, mastics, and patching materials still contain asbestos (see Chapter 4).

**Hazardous Building Materials At Army Facilities**

- Hazardous materials can be encountered during:
 - Operations and maintenance activities, repair and replacement
 - Building conversion or repurposing projects
 - Building demolition projects
 - New construction



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Hazardous building materials can be encountered during operation and maintenance activities; an example would be resealing windows where the existing caulk contains PCBs.

With military construction (MILCON) programs winding down, fewer new facilities will be constructed. So, converting or repurposing existing buildings for a new function or mission is the strategy to accommodate changing facility requirements. As part of that effort, projects may involve more extensive work to be done through partial demolition and new construction/renovation. In this situation, hazardous building materials may be

encountered in walls, ceilings, floors, windows, roofing materials, mechanical systems, and electrical systems. Additionally, hazardous building materials are often concealed by finished surfaces or have been covered by previous upgrades. Thus, hazardous building materials may need to be removed before renovations can commence or continue.

Complete building demolition presents a similar scenario in that hazardous building materials may be found virtually anywhere in the building. Hazardous building materials must be removed prior to demolition. Discovering previously undetected hazardous building materials or materials suspected of being hazardous will require the demolition to be stopped and the materials removed before demolition can resume.

Even the construction of new facilities is subject to the inclusion of hazardous building materials. Care must be taken to verify that new materials are hazard-free and toxin-free before being approved for use. Even if new materials are not classified as hazardous or toxic, they may not be completely hazard-free. Synthetic materials subject to off-gassing volatile organic compounds (VOCs) should be avoided if at all possible. Low-VOC or no-VOC materials should be selected wherever possible.

**Hazardous Building Materials At Army Facilities**

- Individuals impacted by hazardous building materials:
 - Tradespersons
 - Building occupants
 - Personnel involved in handling, transportation, and disposal activities


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Repair and maintenance activities may take place when the building is still occupied. Even if the work does not directly involve a hazardous building material, disturbing materials can still release contaminants into the occupied environment; an example would be replacing a suspended ceiling system which has been contaminated by friable asbestos from pipe insulation

above. A building that has been converted or repurposed for a different function must also be certified as environmentally clear before its new occupants can move in.

Improper handling, packaging, or transportation of hazardous building materials removed from buildings can cause releases into the environment. Disposal in a facility not permitted for hazardous building materials can also result in releases to the environment. Each of these deficiencies can result in fines and criminal prosecution.

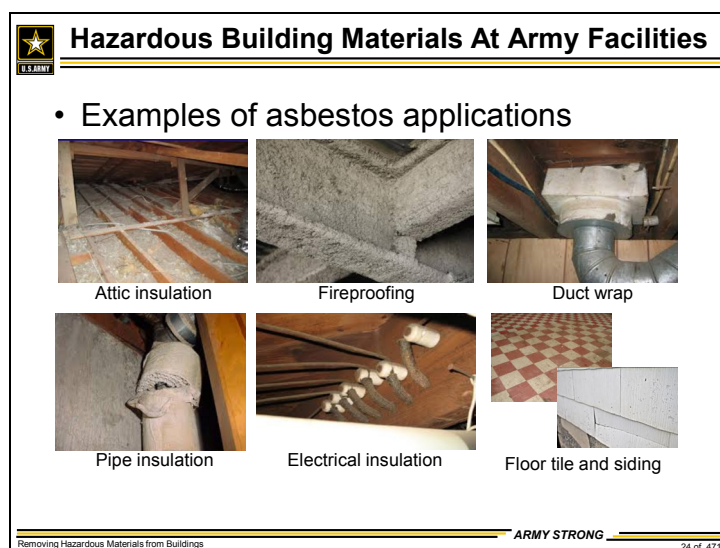
2.4.1 Asbestos

**Hazardous Building Materials At Army Facilities**

- Asbestos was commonly used in:
 - Roofing materials
 - Floor tiles and mastics
 - Wall board and joint compounds, surface textures
 - Heating system insulation and heat shields
 - Building insulation
 - Fireproofing steel structural members
 - Electrical insulation
 - Siding materials
 - Glazing compounds
- Some new building materials have an asbestos content.

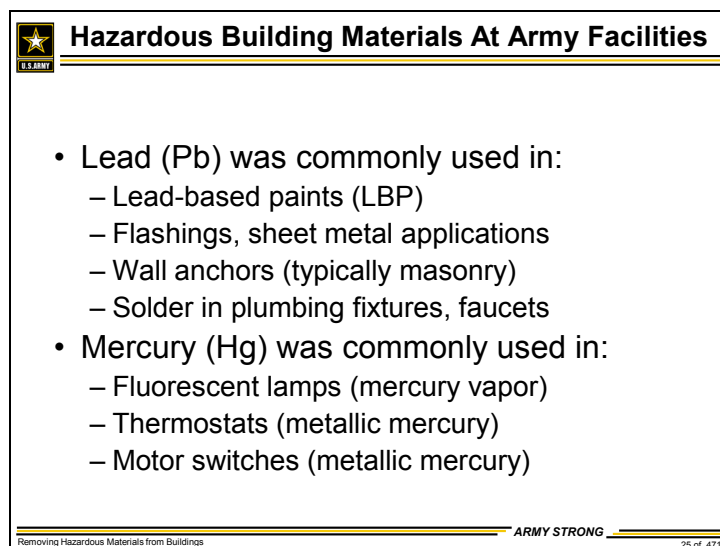
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Asbestos was also commonly used in some types of asphalt shingles. Unfortunately, as will be explained in Chapter 4, asbestos is still available in some of these products if they are not manufactured in the United States.



Some examples of asbestos applications at Army installations (some of which are shown in the graphic above) are: attic insulation, wall insulation, fireproofing steel structural members, ductwork wrap and insulation, pipe insulation, insulation of electrical wiring, vinyl asbestos floor tiles, and cement asbestos board used as exterior siding.


2.4.2 Lead and mercury





Concerning lead, it is important to know that exterior LBP was typically formulated with a higher lead concentrations than interior paint. As for mercury, it is still in use today in newly manufactured fluorescent lights. Some common examples of lead and mercury applications are pictured below.

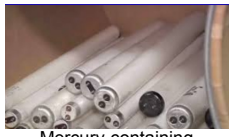
Hazardous Building Materials At Army Facilities

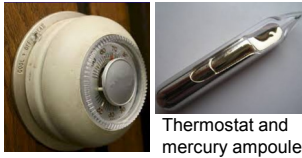
- Example applications of lead and mercury

 Exterior and interior LBP

 Lead flashing

 Lead-soldered plumbing

 Mercury-containing fluorescent lamps

 Thermostat and mercury ampoule

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2.4.3 Polychlorinated biphenyls (PCBs)

Hazardous Building Materials At Army Facilities


- Polychlorinated biphenyls (PCBs) were commonly used in:
 - Electrical transformers
 - Fluorescent lamp ballasts
 - Caulks and paints

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Concerning PCBs, in addition to their well-known use in electrical equipment, they were also used in caulks and paints where a high degree of elasticity was required, often in industrial-type facilities. Some common examples of PCB applications are pictured below.

**Hazardous Building Materials At Army Facilities**


- Example applications of PCBs



PCB-containing electrical transformers




PCB-containing fluorescent lamp ballast



PCB-containing caulks and sealants

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2.4.4 Treated lumber and mold

**Hazardous Building Materials At Army Facilities**


- Treated lumber was commonly used for:
 - Exterior decks, porches, stoops, and similar structures
 - Floor and wall framing where not exposed to interior spaces
 - Plywood sheathing where not exposed to interior spaces
 - Exterior decorative wood such as lattice or fencing
- Mold may be found in
 - Wet areas such as showers and kitchens
 - Concealed spaces, wall cavities, above ceilings
 - At leaks and around openings
 - Surfaces immersed in flood water

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Other issues pertaining to mold to note are that concealed cavities are of special interest if they have had insulation added without a vapor retarder put in place. Surfaces immersed in floodwater can include nonstructural materials such as fabrics and carpets as well as wall and ceiling structural surfaces.

**Hazardous Building Materials At Army Facilities**

- Example applications of treated lumber and mold in buildings




Copper Chromium
Arsenate treated lumber



Mold in concealed
spaces

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2.5 Summary of important issues

**Summary: Important Issues**

- Hazardous and regulated materials are present in Army buildings, both older and newer.
- Removing these materials may be required:
 - for occupant safety and/or
 - before any construction or demolition work can be performed.
- Removal, disposal, reuse, and recycling of hazardous building materials must also be done according to specific regulations.
- Failure to comply with the applicable regulations and practices can result in BIG trouble for the installation and the individuals involved.

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Hazardous building materials and other regulated materials are present in Army buildings. Buildings may be older and were constructed when these materials were acceptable. In addition, not all problematic materials have been banned. New buildings may also contain some regulated materials.

Removing these materials may be required to reduce health and safety hazard to building occupants. Removing these materials may also be necessary prior to performing any construction to convert or repurpose a building to a new function or mission, or prior to demolishing it.

Removing these materials must be performed in accordance with the applicable laws and regulations. Failure to comply with the applicable laws and regulations can result in fines, penalties, and even criminal actions against project personnel.

Subsequent sections in this course will describe where specific hazardous building materials are likely to be found in buildings and how to manage them.

3 OACSIM Guidance for Installation-Level Toxics Management

This section of the curriculum discusses OACSIM's perspective on hazardous building materials, along with expectations as to how they will be handled. NOTE: OACSIM refers to the materials as "toxics" rather than the "hazardous building materials" terminology used throughout this course.


3.1 PWTB 200-1-144: Toxics Management

As previously stated in Chapter 1, the DAIM-ODF completed a PWTB in 2014 titled *Toxics Management* that was published through HQUSACE. A PWTB is a "how-to" document directed toward an Army installation's DPW personnel. A PWTB is instructive in nature, but it does not have the authority of a regulation. Its guidance is directed toward installations' DPWs and other engineering activities that operate and maintain Army facilities.

This portion of the curriculum does not "teach" the PWTB but rather, it includes OACSIM's guidance as a part of the larger hazardous building materials management subject.

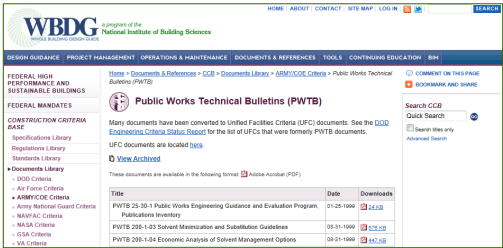
All PWTBs are available electronically at the National Institute of Building Sciences' Whole Building Design Guide webpage.²

² http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215



PWTB Toxics Management


- PWTB 200-1-144, *Toxics Management* (prepared by ACSIM and approved October 2014) is available on Whole Building Design Guide, Construction Criteria Base:
- http://www.wbdg.org/ccb/ARMYCOE/PWTB/pwtb_200_1_144.pdf



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3.1.1 Overview of content

PWTB 200-1-144 provides guidance to address specific toxic and hazardous materials that are associated with buildings (and some structures) that are owned, leased, or otherwise controlled by the DA. It provides basic guidance on how to detect, evaluate, control, or remove the subject toxic materials.




Overview of PWTB

- The PWTB provides guidance to address specific toxics associated with buildings and is applicable to:
 - Garrison leadership and senior managers of the Directorate of Public Works (DPW)
 - Technicians, supervisors, and persons doing the actual daily work; written at a “how to” level.
 - Installation DPW and other engineering activities that operate and maintain Active Army, Army National Guard, and U.S. Army Reserve facilities.
 - USACE offices supporting installations.

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The term “toxic” is not specifically defined by OACSIM, but it is assumed to include the issues covered by the PWTB, as shown in the next graphic.



Overview of PWTB


- As used in the PWTB, “toxics” refers to:
 - PCBs
 - Asbestos
 - Lead
 - Radon

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Detailed guidance on each specific toxic is presented in individual appendices of the PWTB. However, Appendix A of the PWTB provides general program guidance on the management and handling of toxics.



Organization of PWTB

- Appendix A provides general management guidance.
- Appendices B, C, D, and E include guidance for asbestos, PCBs, lead-based paint, and radon, respectively.

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3.1.2 PWTB 200-1-144: Appendix A content

The most effective way for an installation Commander to comply with federal, state, and local toxics management regulations is to appoint an installation-level Toxics Management Coordinator and establish an installation Toxics Management Team (TMT). The team can be established as a standing installation team, an ad hoc or process action team, a subcommittee of the Installation Environmental Quality Control Committee, or any other method determined by the installation Commander.

The TMT's duties includes developing the installation's Toxics Management Plan (TMP), including project documentation and programming for funds. Additionally, the TMT will develop public awareness and worker education programs to communicate the risks associated with exposure to toxics, ways to prevent or control exposures, and corrective actions to prevent, manage, and abate hazards.

It should be noted that the 2007 version of AR 200-1, "Environmental Protection and Enhancement" requires the establishment of a lead hazard team and an asbestos management team. Until the new version of AR 200-1 is published, it will not be known if the TMT replaces those functions or is an adjunct.



PWTB 200-1-144, Appendix A

- Establish a Toxics Management Team (TMT)
 - Develop an installation Toxics Management Plan (TMP)
 - Develop public awareness and worker education programs
- TMT should include representatives from:


<ul style="list-style-type: none"> – Installation Command – Housing – Medical – Safety – Legal – Public Affairs – Other specialists, as required 	<ul style="list-style-type: none"> – Community health – Child development – Contracting – Labor Unions – Community services – USACE
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The slide below reflects the suggested elements for the TMP. The TMP must be in writing. Installations are free to structure their plan and processes to best suit their situation. The Garrison Commander or delegated official needs to review and approve the installation's TMP. Whether it is titled as a: plan, operation plans (OPLANs), standard operating procedures (SOPs), or by some other name is less important than whether the TMP's successfully demonstrates that the installation has the situation in hand, knows its strengths and weaknesses, and is actively striving to improve.

When defining its TMT, a good approach is for an installation to use a core team to coordinate overall management with subteams of specialists who are trained to manage specific toxics. Do not include subteams for toxics that do not exist on the installation. Instead, in the TMP, document the

reason that a subplan or subteam is not needed for certain toxics; substantiate this reason with scientific documentation.




Appendix A

- Toxics Management Plan elements:
 - Format
 - Distinct plan; independent or part of other OPLAN or SOP
 - Approved by installation's Command
 - Toxics Management Team
 - Core team
 - Specialized team(s) according to specific materials
 - Inventory
 - Location
 - Characterization
 - Current status, actions

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An inventory of toxics begins with knowledge of the installation's real property inventory. In the near term, installations will rely heavily on local lists and databases to inventory where toxics exist and what is being done to manage them. In the midterm, look for more detailed guidance as initiatives come on line and mature such as: environmental liability programs, building information modeling (BIM) processes, or the Army's new enterprise resource planning system known as General Fund Enterprise Business Systems (GFEBS). It is important to update inventories periodically for newly identified toxic materials and building or material aging, renovation, or abatement. Updating survey data on a two-year cycle is suggested.



Appendix A

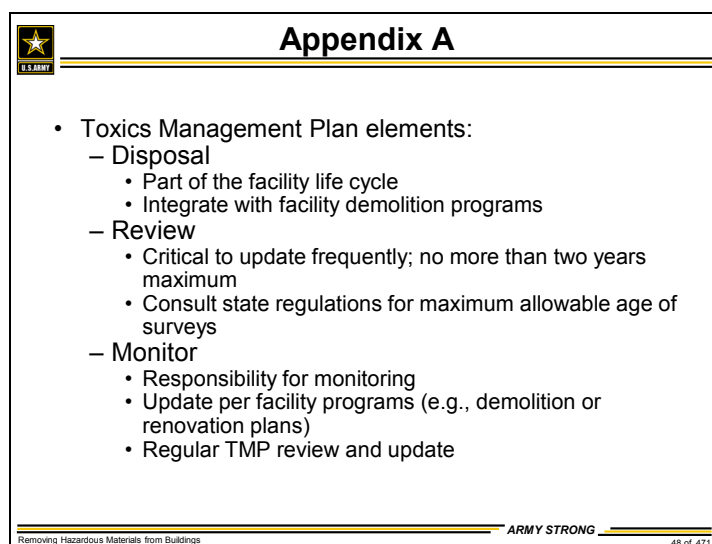
- Toxics Management Plan elements
 - Risk Analysis
 - Integrate the lessons of Department of the Army Pamphlet (DA PAM) 385-30, "Mishap Risk Management," (U.S. Army 2007a) into toxics planning
 - Prioritized project list
 - Independent action initiated by DPW, as necessary
 - Inclusion of toxics management within Military Construction (MILCON), Operations and Maintenance, Army (OMA), Facilities Reduction Program (FRP), base realignment and closures (BRAC), and other facility programs
 - Communications
 - Building occupants
 - Construction and maintenance trades
 - Documentation of communications

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Use of risk analysis and risk management techniques is important because their use will help to avoid damage to either human or environmental health. Installations should integrate the lessons of DA Pamphlet (PAM) 385-30, "Mishap Risk Management" into their toxics planning so that there are no, or at least minimal, surprises along the way. A DA-PAM is an informational document that, like a PWTB, does not carry the authority of a regulation.

The prioritized project list is one of the more complex elements of the TMP. Installations should make use of standard programs and project management products that are based on business practices of the prospective component in order to integrate toxics management-related projects into the overall planning and programming effort. Examples of these products include the U.S. Army Installation Management Command (IMCOM) Project Prioritization System (PPS); Military Construction, Army (MCA) ProjDoc; or Planning Resources for Infrastructure Development and Evaluation (PRIDE). Proper project development for any type of project requires time, effort, and good staff work; toxics management projects are no exception.


Installation toxics managers should be as aware of their audiences and imperatives as is Garrison leadership. By law, some specific information must be communicated to occupants of buildings (e.g., lead hazards). Garrisons may also wish to involve the Public Affairs Office (PAO) in their planning and information dissemination. Communicating with workers and technicians may be handled through bulletins, tool box safety meetings, or staff meetings. Installations have many different needs and may use a different mix of communications to meet their needs. Documentation of information delivery is highly recommended and in some cases, documentation is required by OSHA or the EPA to prove the training actually happened, in case of a future claim for damages.



Disposal of obsolete or excess facilities is a routine part of any facility's life cycle, so the TMP should ensure that toxics management planning is incorporated into and supports the facility's life cycle. This plan should support the efforts of the Installation Real Property Master Planner and provide sound advice on what is needed to prepare any given facility for demolition or other disposal. The installation's Environmental Office should also be involved to assist with disposal of regulated building materials or contaminated soil issues. The installation TMP should play a major role in the planning and programming of facilities.

The TMP and its components should be reviewed and updated as necessary, but no less frequently than every other year. Many states have limitations on how old toxics surveys can be, and a regular review will assist in identifying facilities that need updated surveys.

The post needs to ensure that the plan clearly defines responsibilities if there is to be any expectation that it will be implemented. Care must also be given to ensure that elements are updated (e.g., demolition and/or repurposing lists), and that they are passed to the TMT for inclusion in the installation TMP when elements of the TMP have undergone change. Regular meetings of the TMT should review and update toxics management planning documentation in general.




Appendix A

- Building demolition
 - Toxics must be removed before demolition activities can begin.
 - Includes structural demolition, gut rehab, and architectural demolition (e.g., soft-strip or salvage).
 - Also applies to building remodeling and renovation.

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When developing the plan, the installation needs to consider the PWTB's guidance that the installation, through the Toxics Management Coordinator, will ensure that all regulated toxic-contaminated materials are removed from buildings before deconstruction and demolition begins. Metal, wood, glass, and other recyclables cannot be removed by recycling contractors until all of the hazardous building materials have been removed. Materials such as mercury-containing florescent tube lights and switches; PCB-containing ballasts, transformers, and capacitors; hydraulic fluid; and paint and caulk containing more than 50 ppm (parts per million) of PCBs must be identified and removed before any value items such as stainless steel, brass, copper, wood, and glass can be removed.



Appendix A

- Recordkeeping
 - The PWTB cites BIM, GEFEBs and BUILDER™ as potential tools for recording toxics locations and condition assessment data.
 - Most-accurate data typically resides locally, at the DPW.


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Recordkeeping is required for each toxic material, but it is an evolving process. At a minimum, recordkeeping requires implementing procedures to identify, store, protect, retrieve, retain, and dispose of existing paper or electronic records.

Building information management system (BIMS) software now offers one method of capturing information about toxics in buildings. The BIMS will permanently maintain this data for future base realignment and closure (BRAC) reorganizations or closures.

As stated previously, the Army's real property records are expected to eventually migrate to an emerging enterprise resource planning (ERP) known as GFEBS. GFEBS may become a useful tool for recording toxics location and condition data in the future.

Other recordkeeping possibilities include using "smart management systems" such as the existing Army-owned BUILDER™ program, specifically the BUILDER Functionality Assessment feature. As the building and its systems are evaluated for their operational condition, the presence and condition of toxic materials can be recorded.



Appendix A

- Training requirements:
 - Technical training
 - Provides technical expertise to personnel assigned to toxics management duties.
 - Awareness training
 - Training that should be given to individuals who may be impacted by the presence of toxics.
 - May vary per state and per hazardous material.
 - Include a training plan in the TMP that gives:
 - Personnel
 - Training requirements
 - Refresher requirements

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Some identified toxics, such as asbestos and lead, have very precise, mandatory training requirements. Other identified toxics, such as PCBs and radon, have no or few training requirements. Training requirements may also vary from state to state.

Training can be divided into two categories:

- *Technical training* is required training that provides technical expertise to personnel who are assigned to toxics management duties.
- *Awareness training* is training that should be given to individuals who may be impacted by the presence of any of the toxics addressed in this document.

The installation's TMT will develop a training plan that will identify personnel who need to be trained and the type of training required. Care needs to be taken to ensure that mandated refresher training courses are incorporated into the training plan.



Other Appendices

- Specific requirements for asbestos, lead, PCBs, and radon are included in PWTB Appendixes B, C, D, and E, respectively.
- Guidance for each of those toxic materials will be included in this training curriculum.

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Chapters 4 through 10 of this document provide material-specific information for the toxics covered in PWTB 200-1-144 as well as other hazardous building materials.

4 Asbestos


Asbestos is a term we have all heard and believe we are familiar with, but it is a topic that still needs to be discussed as a very real hazard.

4.1 Terminology

Although both EPA and OSHA define what the term “asbestos” means, they define it differently. The important thing to know is that from a human health perspective, the OSHA definition is much broader.

Terminology	
OSHA Definitions <ul style="list-style-type: none"> • Asbestos - includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that has been chemically treated and/or altered. For purposes of this standard, "asbestos" includes presumed asbestos-containing material (PACM) (29 CFR 1926.1101(b)). 	EPA Definitions <ul style="list-style-type: none"> • Asbestos - the asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite (40 CFR 61.141).

The OSHA definition references the term PACM, which stands for “Presumed Asbestos Containing Material” and is defined as thermal system insulation and surfacing material found in buildings constructed no later than 1980. The designation of a material as “PACM” may be rebutted (29 CFR 1926.1101(b)).




Terminology

- Additional EPA Definitions:
 - *Asbestos-containing waste materials* means mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of 40 CFR 61.141.
 - Term also includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. However, as applied to demolition and renovation operations, this term includes regulated ACM waste and materials contaminated with asbestos including disposable equipment and clothing. (40 CFR 61.141)

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The definition of “asbestos-containing waste materials” is an example of where the EPA and the OSHA rules intersect, however. In the definition, the rule uses the acronym “ACM” for asbestos-containing materials, but that acronym is not defined in 40 CFR 61.141. Instead it is defined by OSHA (see next slide).



Terminology

- Additional OSHA definition:
 - *Asbestos-containing material (ACM)* - any material containing more than 1% asbestos (29 CFR 1926.1101(b)).


How do you know if it has > 1% asbestos?

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To answer the “how do you know” question about asbestos content for a new product, you can check the Material Safety Data Sheet (MSDS). For an existing structure, consider the dates when asbestos was used and compare that with the age of the building. Buildings built from the 1920s through the 1970s are likely to contain asbestos. Asbestos may have been used in the original construction (e.g., boiler insulation) or asbestos may

also have been added during renovations (e.g., by blowing in wall or attic insulation).

In any case, the correct answer is that any material suspected of containing asbestos must be tested in a laboratory.



Terminology


- Additional EPA definition:
 - *Friable asbestos material* is any material containing more than 1% asbestos, as determined using the method specified in appendix E, subpart E, 40 CFR 763, section 1, Polarized Light Microscopy (PLM).
 - When dry, it can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10% as determined by a method other than point counting by PLM, verify the asbestos content by point counting using PLM (40 CFR 61.141(b)).

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When speaking about asbestos, one of the most common references made is whether or not it is “friable.” The EPA definition of “friable” that is shown above will determine which EPA controls are used, but how the asbestos-containing waste is disposed of may depend on the friability of the waste.

OSHA does not use the term “friable.” Instead, OSHA regulates asbestos in terms of permissible exposure limits (PELs). Employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. Short-term exposure must also be limited to not more than 1 f/cc, averaged over 30 minutes. Rotation of employees to achieve compliance with either of these PELs is prohibited.

Then to really confuse things, the EPA added yet another definition to try and capture anything that might have fallen through the cracks. Note, however, that the definition shown on the next slide is the one to be observed.



Terminology

- Additional EPA Definition
 - *Regulated asbestos-containing material (RACM)* means: (a) friable asbestos material; (b) Category I nonfriable ACM that has become friable; (c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or (d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations as regulated by 40 CFR 61, Subpart M (40 CFR 61.141(b)).

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The important issue is to pay close attention to *which* terminology is being used, *when* it is being used, and *how* it is being used in your contracts, with personnel, and on disposal documentation. Also remember, an individual state can be more stringent in how it defines the terms related to asbestos waste materials.

4.2 History of use

Asbestos mining is believed to have begun over 4,000 years ago. Asbestos was used by both the Greeks and Romans for its fire-resistant properties. It could be woven into cloth, wetted and applied to surfaces, or simply pressed into a sheet that could be used as a cooking surface over a fire. Pliny the Younger wrote in 61-114 AD that slaves who worked with the mineral asbestos became ill.³

Common use of asbestos fell out of favor in the Middle Ages but re-emerged in the 1700s. But it was during the Industrial Revolution in the late 1800s when asbestos really came into its own. The constant fear of fire in the wooden structures and the growing use of more and more machinery driven by fire created a market for asbestos. It was valued for its sound absorption; average tensile strength; resistance to fire, heat, electrical and chemical damage; and affordability.

³ <http://www.asbestos.com/asbestos/history/>



History of Use

- Term comes from ancient Greek meaning “inextinguishable.”
- Popular in the United States during the Industrial Revolution.
- History of 20th century industrial use and delay in addressing the hazards involved with asbestos is well documented. See <https://www.osha.gov/osa40/timeline.html>

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In the 20th century, asbestos was actively used—and championed to be used—for everything from fire protection suits for airmen and firefighters to hot pads for home use.

In 1971, OSHA began regulating an individual’s exposure to asbestos in the context of mining. The initial regulations resulted in lawsuits, but the regulation was upheld by the courts in 1974. The legal history of defining the exposure limits and exactly what was covered by those limits carried on through the 1980s: details can be found on the OSHA website: <https://www.osha.gov/osa40/timeline.html>.

Taking a cue from OSHA, and learning a few things through observation, the EPA decided to address the issue of asbestos in a way the average American household would understand—their children and asbestos exposure in school.

4.3 Use by U.S. Army

The following slides depict common uses of asbestos-containing materials by the U.S. Army:



Use by the Army

Vinyl floor tile and the backing on vinyl sheet flooring and associated adhesives






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The rule of thumb for considering asbestos content in vinyl floor tile is that smaller tiles (e.g., 9 inch) are likely candidates for asbestos content. Larger tiles (e.g., 12 inch) are unlikely to contain asbestos.



Use by the Army

Cementitious floor coatings



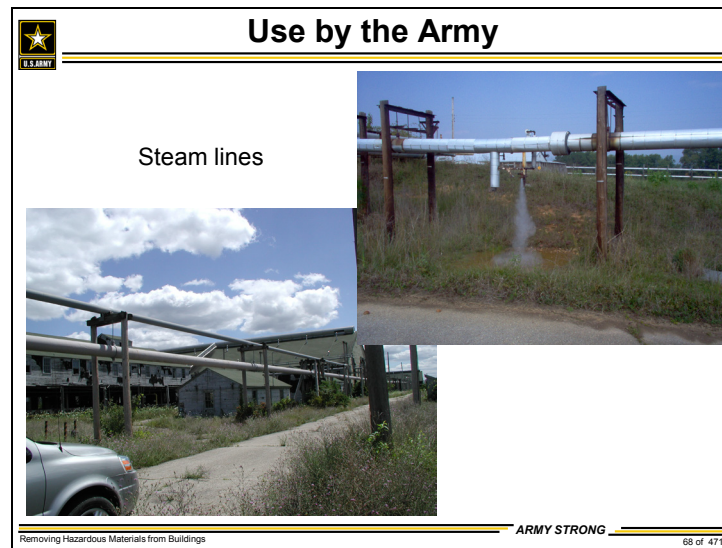


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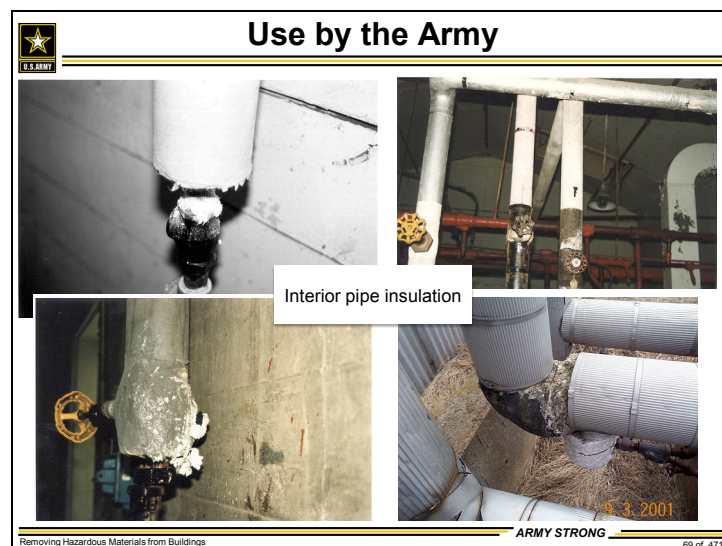
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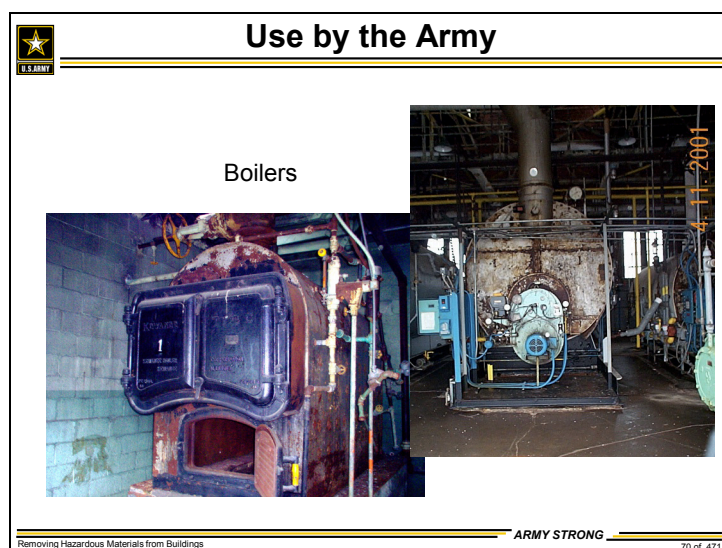
Cementitious floor coating was employed as a durable, fireproof, non-sparking coating in industrial buildings. It is often red-orange in color and can be placed over wood or concrete subflooring. It is also sometimes called “oxy-chloride” flooring, and it contains magnesium oxide, sawdust, asbestos, and fine aggregates.



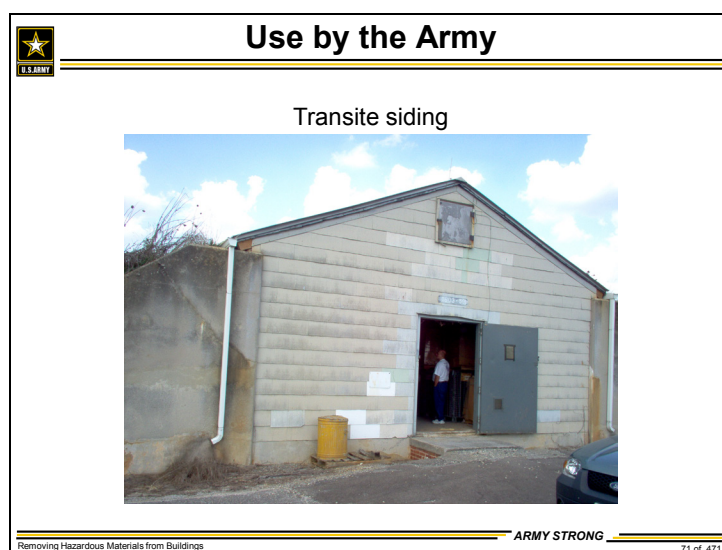
The asbestos associated with steam lines may become a more prevalent disposal issue, as installations move away from central heating in favor of distributed systems.



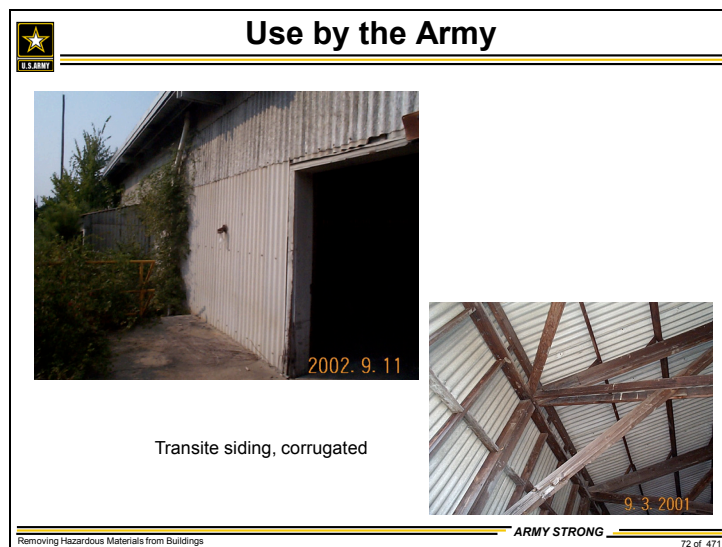
Asbestos wrap or insulation can be found in areas wherever there might have been concerns about fire or heat containment.



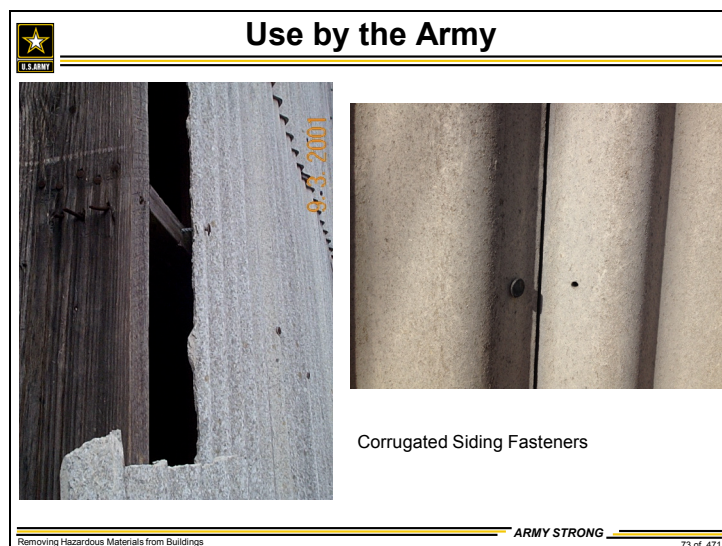
For old boilers, always suspect any insulating material in, on, or near them.




This type of ACM is cement-fiber siding in shingle form. The original trade name of Transite™ has evolved into being used as the generic term for this type of material. It was used as an original siding material in mid-20th century buildings, and it was often applied as a secondary material over the original wood siding.



Corrugated transite siding was commonly used on warehouses or other large industrial buildings. It comes in 4 x 8 sheets and was used as both roofing and siding.




Corrugated transite was attached to the structure with nails or screws. To remove the sheets, one must cut the attaching hardware and try to remove the sheets intact.





Use by the Army

- Additional common locations for asbestos in buildings:
 - Attic and wall insulation containing vermiculite
 - Roofing and siding shingles along with felt
 - Textured paint and patching compounds used on wall and ceilings
 - Walls and floors around wood-burning stoves protected with asbestos paper, millboard, or cement sheets
 - Heat-resistant fabrics


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Use by the Army



Vermiculite granules



Popcorn paint texture

Transite heat shields

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Flat transite sheets were used on building interiors for fireproofing and for heat resistance adjacent to or under space heaters.

Vermiculite insulation was used as a “pourable” insulation in attics, in the stud cavities of wall construction, and in cavities between the blocks of masonry construction and bricks as well as in the hollow cores of concrete blocks.

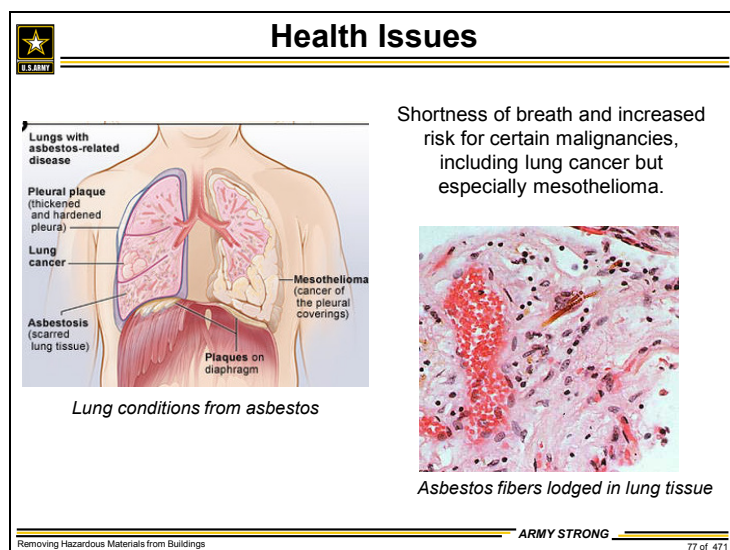
Asbestos was used to give paint a texture, commonly known as “popcorn” texture. While most common on ceilings, “popcorn” texture was occasionally applied to walls too.

4.4 Health issues

The most commonly known health concern for asbestos is the development of asbestosis. Asbestosis develops after extensive occupational exposure to asbestos, most commonly occurring during the mining, manufacturing, handling, or removal of asbestos. The death of an English textile worker, Nellie Kershaw, in 1924 is the first description of death related to industrial asbestos exposure (Selikoff and Greenberg 1991). By 1930, major medical journals began to publish articles that linked asbestos to cancer.

Unlike some exposures to toxic substances, harmful exposure to asbestos typically does not reveal itself until long after the actual exposure, which can sometimes be even decades later.

At this time, there is no curative treatment for asbestosis.



The current regulations issued by OSHA were implemented to prevent the development of asbestosis for people who continue to work in environments where there is friable asbestos. The regulations issued by EPA were enacted to prevent friable asbestos from becoming free-floating and impacting people who are not directly working with it, and to prevent it from entering our sources of drinking water. According to EPA, the maximum contaminant level for asbestos is 7 million fibers per liter > 10 ppm (MFL) (40 CFR 61.141.51). From a nonairborne perspective and according to the

EPA, people who drink water containing asbestos in excess of the maximum contaminant level (MCL) for many years may have an increased risk of developing benign intestinal polyps.

Per the Agency for Toxic Substances and Disease Registry (ATSDR)⁴:

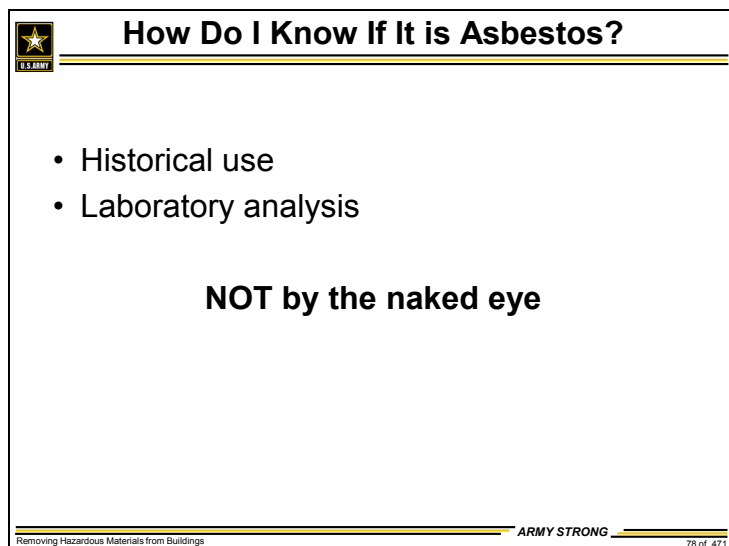
- When asbestos fibers are inhaled, most fibers are expelled, but some can become lodged in the lungs and remain there throughout life. Fibers can accumulate and cause scarring and inflammation. Enough scarring and inflammation can affect breathing, leading to disease.
- The term “naturally occurring asbestos” refers to the mineral as a natural component of soils or rocks, as opposed to asbestos in commercial products, mining, or processing operations. Naturally occurring asbestos can be released from rocks or soils by routine human activities such as construction or from the natural weathering process. If naturally occurring asbestos is not disturbed and fibers are not released into the air, then it is not a health risk.
- People are more likely to experience asbestos-related disorders when they are exposed to high concentrations of asbestos, are exposed for longer periods of time, and/or are exposed more often.
- Inhaling longer, more durable asbestos fibers (such as tremolite and other amphiboles) contributes to the severity of asbestos-related disorders.
- Exposure to asbestos can increase the likelihood of lung cancer, mesothelioma, and non-malignant lung conditions such as asbestosis (restricted use of the lungs due to retained asbestos fibers) and changes in the pleura (lining of the chest cavity, outside the lung).
- Changes in pleura such as thickening, plaques, calcification, and fluid around the lungs (pleural effusion) may be early signs of asbestos exposure. These changes can affect breathing more than previously thought. Pleural effusion can be an early warning sign for mesothelioma (cancer of the lining of the lungs).
- Most cases of asbestosis or lung cancer in workers occurred 15 years or more after the person was first exposed to asbestos.
- Most cases of mesothelioma are diagnosed 30 years or more after the first exposure to asbestos.

⁴ http://www.atsdr.cdc.gov/asbestos/asbestos/health_effects/

- Asbestos-related disease has been diagnosed in asbestos workers, family members, and residents who live close to asbestos mines or processing plants.
- Health effects from asbestos exposure may continue to progress even after exposure has stopped.
- Smoking or cigarette smoke, together with exposure to asbestos, greatly increases the likelihood of lung cancer.

4.5 Detecting asbestos-containing materials

ACMs are not detectable with the naked eye.



The historical use of asbestos and ACM, common uses of similar applications, and building age can suggest that ACM may be present in a given building. Examples may include a record of asbestos hot-water tank insulation in similar building types on the installation, or asbestos-containing roofing mastic used for repairs during a given time period. These situations would suggest the presence of asbestos, but would not verify it.

There are methods to determine the presence of ACM, as described in the subsections that follow.

4.5.1 Analyzing airborne asbestos

The current revision of the National Institute of Occupational Safety and Health (NIOSH) Method 7400 is employed for phase contrast microscopy (PCM) analysis.

Transmission electron microscopy (TEM) represents the most sophisticated technology available for characterizing asbestos minerals. This technique is now the standard for most airborne investigations, including post-abatement clearance testing as well as diagnostic and environmental monitoring activities. A list of TEM-accredited labs is available from the National Institute of Standards and Technology (NIST).⁵

4.5.2 Analyzing bulk building materials

The current method for analyzing bulk building materials is found in EPA 600/R-93/116. Other procedures are also utilized to supplement this method such as NIOSH 9002, and OSHA ID 191. Accreditation is primarily provided by NIST, through the National Voluntary Laboratory Accreditation Program (NVLAP).

4.5.3 Analyzing settled dust and other non-building materials

The analysis of settled dust and other nonbuilding materials for asbestos content continues to be a growing and controversial subject in the environmental industry. Whether to establish baseline levels, to survey historical buildup, or to diagnose episodic releases, the utility of a surface dust analysis has proven itself to environmental professionals.


The established methods published by ASTM International call for detailed field sampling schemes and analysis by TEM. ASTM D5575, D5576, and D6480 have been developed to provide standards for this specialized analysis. Though TEM is the method of choice, proprietary in-house methods using polarized light microscopy (PLM) can be employed.

4.6 Regulation

All of the regulations have associated documentation, reporting, notification, and operational requirements. In addition to national-level regulations, there can be more stringent state regulations such as a reduction in the amount of area impacted before the regulation applies or additional notification/reporting requirements.

⁵ <http://ts.nist.gov/Standards/scopes/temtm.htm>

4.6.1 Federal regulations



How is it Regulated?

- Federal laws/statutes:
 - Clean Air Act
 - Asbestos School Hazard Abatement Act
 - Asbestos Hazard Emergency Response Act (AHERA)
 - Asbestos Information Act (AIA)
 - Safe Drinking Water Act (SDWA)

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The Clean Air Act is the springboard for the EPA's regulations on the handling of asbestos during renovation and demolition activities as well as the disposal of asbestos. The first regulations about emissions of asbestos started appearing in 1971, when asbestos was designated as a hazardous air pollutant along with beryllium and mercury.


The Asbestos School Hazard Abatement Act was promulgated in 1984 and directed the EPA to establish a program to assist states and local educational agencies to ascertain the extent of the danger to the health of school children and employees from asbestos materials in schools, based on the known dangers associated with friable asbestos. This act was then reauthorized in 1990.

The Asbestos Hazard Emergency Response Act (AHERA) is a subpart of the Toxic Substances Control Act (TSCA). It was issued in 1986 and only addresses the management and abatement of asbestos in schools.

The Asbestos Information Act (AIA) was promulgated in 1988 and required those who manufactured or processed asbestos or ACM to report to the EPA, within 90 days after the Act's enactment, on: the years of manufacture, the types or classes of product, and other identifying characteristics reasonably necessary to identify or distinguish asbestos or ACM. As a result of that reporting, EPA then published the submitted information.

The Safe Drinking Water Act (SDWA) was promulgated in 1974, but 40 CFR 61.141.51, imposing a maximum contaminant level for asbestos of 7 MFL, did not become effective until 1992. This standard applies to a public drinking water system. The major sources of asbestos in drinking water are decay of asbestos cement water mains and erosion of natural deposits of asbestos.

4.6.2 OSHA regulations



How is it Regulated?

- When do OSHA regulations apply:
 - 29 CFR 1926.1101 covers construction work including alteration, repair, renovation, and demolition of structures containing asbestos.
 - 29 CFR 1915.1001 covers asbestos exposure during work in shipyards.
 - 29 CFR 1910.1001 applies to asbestos exposure in general industry, such as exposure during brake and clutch repair, custodial work, and manufacture of asbestos-containing products.


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OSHA's asbestos regulations apply based on what the worker is doing. When dealing with construction, renovation, and/or demolition, the regulation of interest is the OSHA Construction Safety Standards, 29 CFR 1926.1101. Within the regulation are requirements for personal protective equipment (PPE), ambient and personal air monitoring, and recordkeeping.

4.6.3 EPA regulations




How is it Regulated?

- When do EPA regulations apply?
 - When doing O&M at a school (including DoDDs).
 - When disposing of asbestos-containing waste.
 - When demolishing structures containing at least 80 linear meters (260 linear feet) of RACM on pipes, or at least 15 m² (160 ft²) of RACM on other components or at least 1 m³ (35 ft³) off facility components.
 - When renovating structures and stripping or removing at least 80 linear meters (260 linear feet) of RACM on pipes, or at least 15 m² (160 ft²) of friable asbestos on other facility components and at least 1 m³ (35 ft³) on facility components.

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4.6.4 Prohibitions




How is it Regulated?

- Asbestos prohibitions:
 - Spray-applied surfacing asbestos containing material (ACM)
 - 1973 – banned by EPA for fireproofing/insulation
 - 1978 – banned by EPA for decorative purposes
 - Spray-on application of materials containing more than 1% asbestos to buildings, structures, pipes, and conduits is prohibited by EPA in 1990 unless certain emission control conditions are met (40 CFR 61, Subpart M)

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Beginning in 1973, the EPA started banning various uses of asbestos. In 1973 it banned the use of asbestos for fireproofing and/or insulation. Other applications were banned in the years that followed.



How is it Regulated?


- Asbestos prohibitions (cont'd):
 - 1975, EPA banned installation of asbestos pipe insulation and asbestos block insulation on facility components such as boilers and hot water tanks, if the materials are either pre-formed (molded) and friable or wet-applied and friable after drying.
 - 1977, the Consumer Product Safety Commission (CPSC) banned the use of asbestos in artificial fireplace embers and wall patching compounds.

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In addition to bans established by the EPA, the Consumer Product Safety Commission (CPSC) also came on board to prevent the use of asbestos in products.



How is it Regulated?

- Asbestos-containing materials
 - Prohibited 1981
 - Friable is defined as when > 1% can be crumbled by hand.
 - Category I Non-friable: > 1% asbestos in packings, gaskets, resilient floor covering, and asphalt roofing products that cannot be broken, crumbled, pulverized, or reduced to powder by hand pressure
 - Category II Non-friable: >1% all other non-friable materials

BUT...

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In 1981, a number of important steps were taken in the regulation of asbestos and the limitation of an individual's exposure to it.

The term ACM was defined and more importantly, the concept of "friable" was defined as being when more than 1% can be crumbled by hand. Then "friable" was further defined into two categories. An example of Category I friable ACM would be floor tiles that can be broken, but not crumbled by hand. An example of Class II non-friable ACM would be mastics in which

the fibers are encased in another resilient material that is not subject to breaking or crumbling.

As could be imagined, all of these definitions and bans caused a great deal of consternation among manufacturers and importers of asbestos-containing products.



How is it Regulated?

- 1989, the EPA issued a final rule under Section 6 of *Toxic Substances Control Act* (TSCA) banning most asbestos-containing products.
 - In 1991, this rule was vacated and remanded by the Fifth Circuit Court of Appeals. As a result, most of the original ban on the manufacture, importation, processing, or distribution in commerce for the majority of the asbestos-containing products originally covered in the 1989 final rule was overturned.


This is why we still find asbestos in imported products, or domestic products if manufactured overseas!

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In 1989, the EPA made a huge move to remove ACM from the marketplace. Subsequently, the EPA's new rule was challenged in court by a variety of manufacturers and importers. Eventually, lower-court decisions that had originally upheld most of the EPA's rule were overturned and made void by the Fifth Circuit Court of Appeals.

But the court *did* uphold portions of the rule. As a result, corrugated paper, rollboard, commercial paper, specialty paper, and flooring felt may *not* contain asbestos. Additionally, the court upheld a provision that banned the use of asbestos in products that have not historically contained asbestos, otherwise referred to as "new uses" of asbestos.

Asbestos may still be found in new building products because imported products could still contain asbestos. Brands based in the United States could also outsource their manufacturing to facilities overseas. Therefore, while the product may be supplied by a domestic company, it may actually have been manufactured overseas. However, to say that all imported products contain asbestos would be incorrect. Thus, installation or USACE quality assurance personnel must be diligent in determining whether products contain asbestos by checking each product's MSDS.



How is it Regulated?

- Due to the 1991 Fifth Circuit Court of Appeals decision, the manufacture, importation, processing, and distribution in commerce of the products listed below containing asbestos, as well as some others not listed, **are not banned**.


Cement corrugated sheet	Cement pipe
Cement flat sheet	Automatic transmission comp.
Clothing	Clutch facings
Pipeline wrap	Friction materials
Roofing felt	Disk brake pads
Vinyl floor tile	Drum brake linings
Cement shingle	Brake blocks
Millboard	Gaskets
Roof coatings	Non-roofing coatings

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The bottom line is that when any of the products listed above are procured, they may still contain asbestos. A contract may stipulate that a product not contain asbestos, but if that is the case, care must be taken to carefully look at product data before approving installation of the product and carefully looking at products themselves when they are delivered to the jobsite.

4.7 Demolition and repurposing concerns

As stated previously many different types of building materials at one time contained asbestos because it was plentiful, inexpensive, nonflammable, strong yet flexible, resistant to chemical corrosion, and a good thermal and sound insulation.




Demolition and Repurposing Concerns

A building probably has asbestos if:

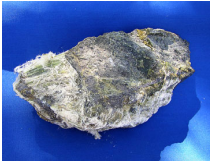
- It was built 1955–1978 and has ceilings that are bumpy, as if coated with cottage cheese or popcorn.
- It was built 1940–1955 and has hard, rock-like shingles, or cementitious siding, or interior surfaces.
- It was built 1940–1983 and has vinyl flooring.
- It was built 1955–1978 and has gypsum drywall walls.
- It has ductwork sealed with white duct tape.
- It has steam lines.
- It has pipe insulation that looks like corrugated cardboard.
- It was built 1920–1978 and has pipe insulation wrapped in canvas.

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Materials become friable if asbestos is liberated from the material matrix. Substances that are easily crumbled or reduced to powder by hand pressure are termed “friable.” Friable ACM requires full containment, monitoring, notification, and disposal at a specially designated landfills. Other substances that are not producing powder with hand pressure are termed “non-friable” and can be removed with minimal amount of containment.

**Demolition and Repurposing Concerns**

- Asbestos-containing materials may release fibers when disturbed, damaged, removed improperly, repaired, cut, torn, sanded, sawed, drilled or scraped.



Chrysotile Asbestos

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Unified Facilities Guide Specifications (UFGS) 02 82 14.00 10, “Asbestos Hazard Control Activities” and UFGS 02 82 16.00 20, “Engineering Control of Asbestos Containing Materials” describe the safety, health, removal, and disposal requirements and procedures to be implemented for building demolition activities. PWTB 420-70-8, *Installation Asbestos Management Program*, provides the latest information on asbestos management and safety procedures.

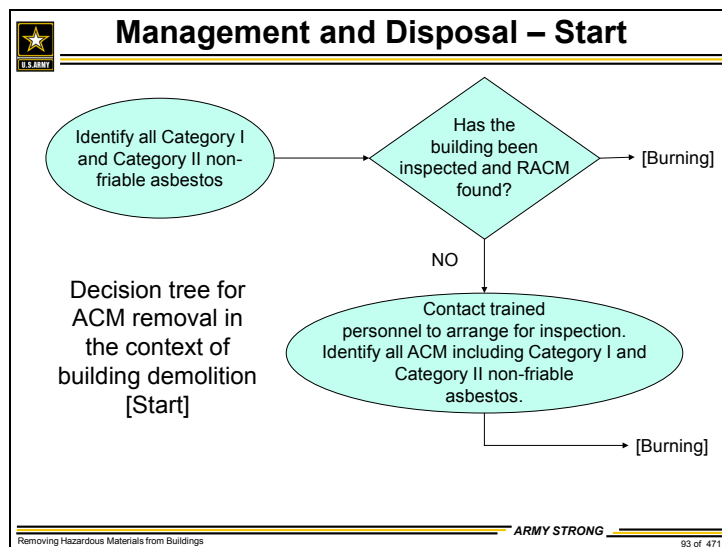
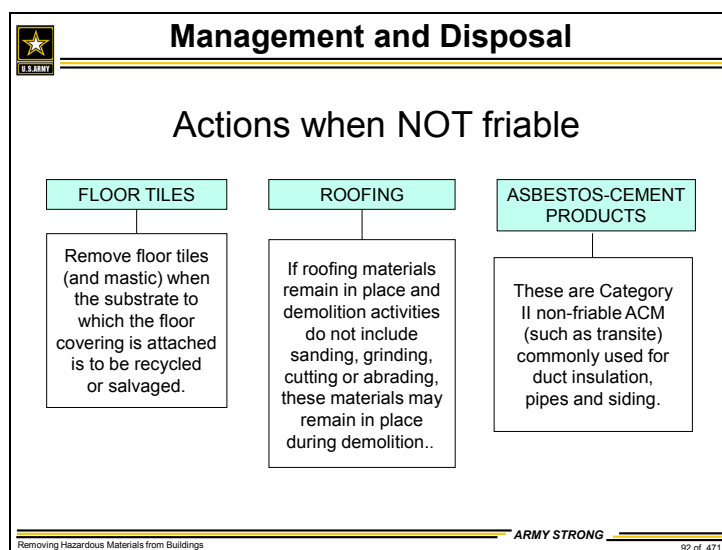
To be certain if a building material contains asbestos, a pre-design survey must be accomplished to obtain detailed data regarding ACM locations and content in building areas to be impacted. Samples must be taken by a person trained to do so and analyzed in an accredited laboratory. The results will indicate whether the material is positive (> 1% asbestos) or negative (< 1% asbestos). USACE has developed an Engineering Pamphlet (EP) 1110-1-30, which details a scope of work for such asbestos surveys.

4.8 Asbestos removal

This group of slides illustrates the decision process for determining whether ACM must be removed before building demolition. Except in

emergency situations, friable materials must always be removed. Under specific circumstances, some non-friable materials may remain inside buildings during demolition, although this determination is up to the interpretation of state regulator and local environmental policy.

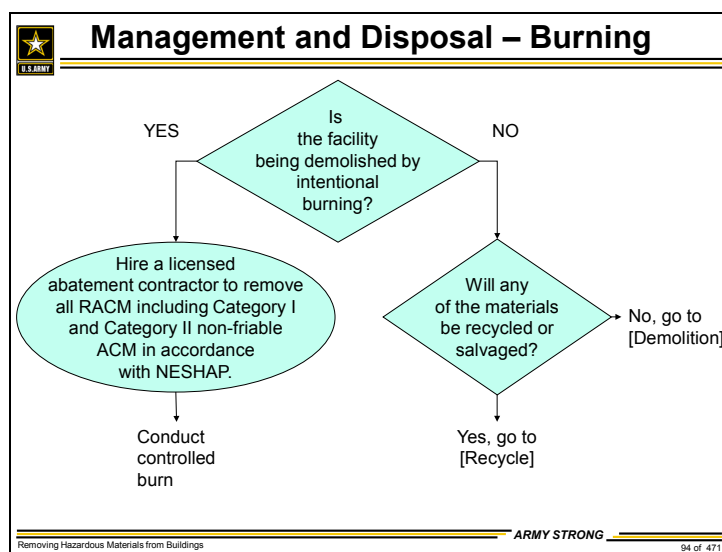
The following slides of decision-tree graphics assume that all friable asbestos has previously been identified and removed:



- Category I non-friable ACMs (e.g., packing, gaskets, resilient floor coverings and mastic, and asphaltic roofing materials) are considered regulated asbestos-containing material (RACM) only when they will be or have been subjected to sanding, grinding, cutting, or abrading, they are

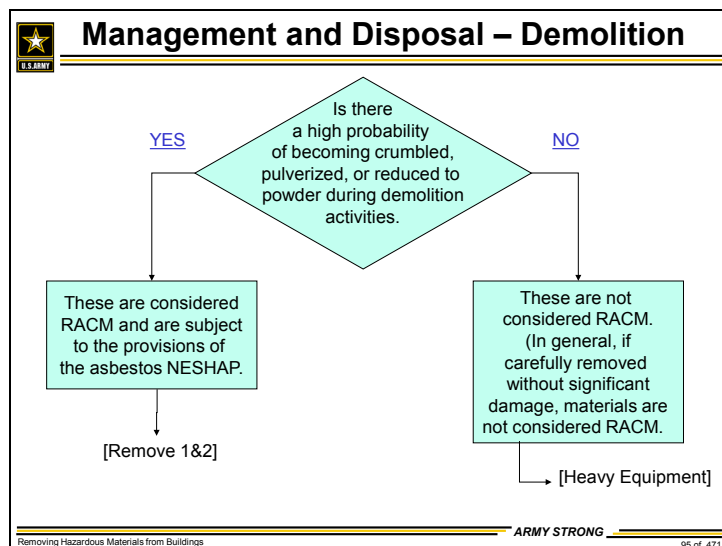
- in poor condition and friable, or the structure in which they are located will be demolished by burning.
- Category II material is all remaining types of non-friable ACM (asbestos cement products such as transite) not included in Category I, that when dry cannot be crumbled, pulverized, or reduced to powder by hand pressure.
 - RACM means: (a) friable asbestos material;; (b) Category I non-friable ACM that has become friable; (c) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces expected to act on the material in the course of demolition or renovation operations.

4.8.1 Burning



The burning of ACM debris should be discouraged due to potential liabilities associated with disposal of the resulting ash. Before accepting ACM debris for burning activities, DPW personnel should ensure there would be no violations of the Clean Air Act's permit conditions for burning buildings, and that the facility will handle all ash in accordance with federal and state hazardous waste regulations.

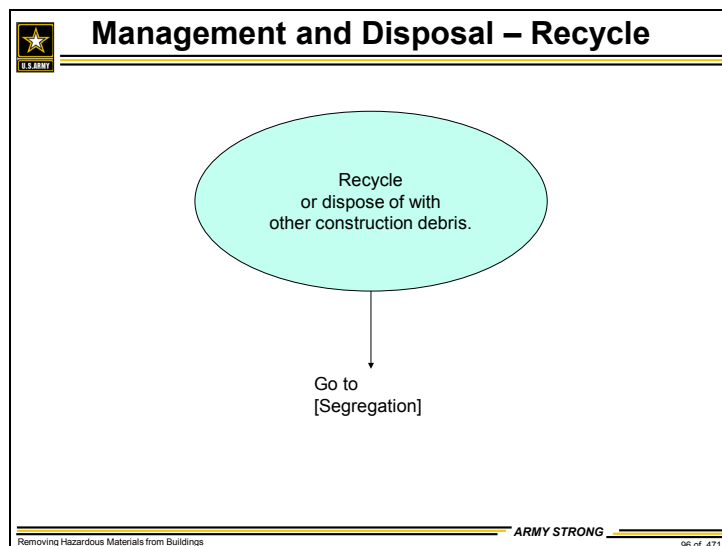
4.8.2 Demolition



Materials that have a high probability of being crumbled, pulverized, or reduced to powder as part of demolition must be removed before demolition begins. Friable and most non-friable ACM should be removed by qualified personnel who are using appropriate controls and protective devices in accordance with OSHA standards, the Toxic Substances Control Act, and the Clean Air Act. The disposal of non-friable ACMs is not regulated at the federal level; however, individual states may have more stringent regulations. ACM that is removed must be labeled as such and disposed of at an authorized landfill. In most cases, these materials can be disposed of in a construction and demolition (C&D) landfill or municipal solid waste landfill, but state and local regulations should be checked beforehand.

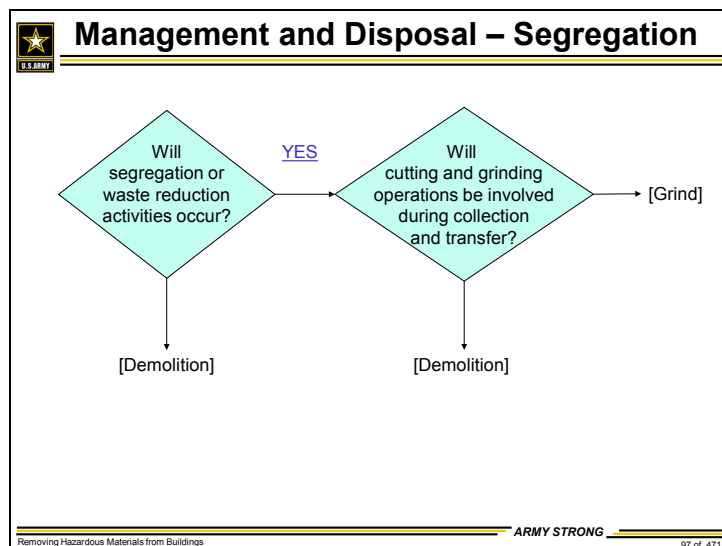
The EPA's regulatory requirements associated with asbestos demolition are found under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations (40 CFR 61). These regulations specify asbestos emission limits and control procedures. Specific demolition and cleanup practices for ACM are provided in Corps of Engineers Guide Specification (CEGS 13280), *Asbestos Abatement*, and the EPA publication, *Demolition Practices Under the Asbestos NESHAP*, EPA/340/1-92-013, 1992.

4.8.3 Recycling



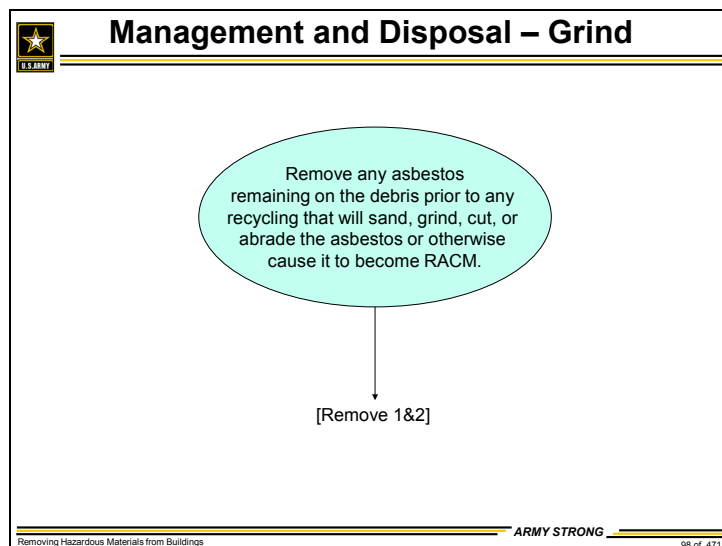
Any materials containing asbestos shall not be recovered for reuse. Asbestos removal and remediation cost thus will be a strong factor in the fate of a structure, determining whether it is economical to reuse or demolish the building.

4.8.4 Segregation



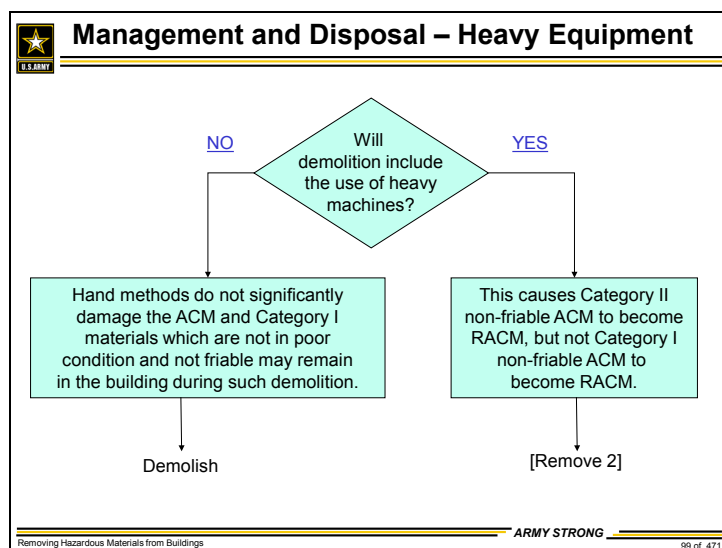
Facility reduction activities are most likely to cause Category I and Category II non-friable ACM to become RACM. Again, asbestos removal and remediation cost will be a strong factor in the fate of a structure, determining whether it is economical to reuse or demolish it.

4.8.5 Grind

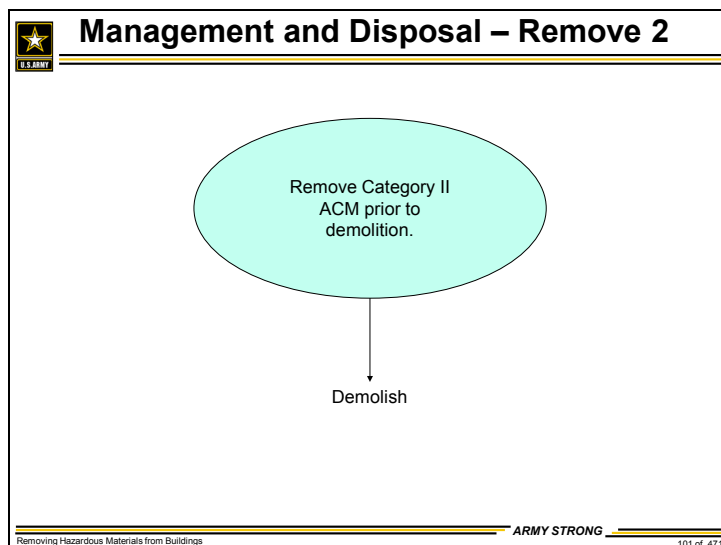
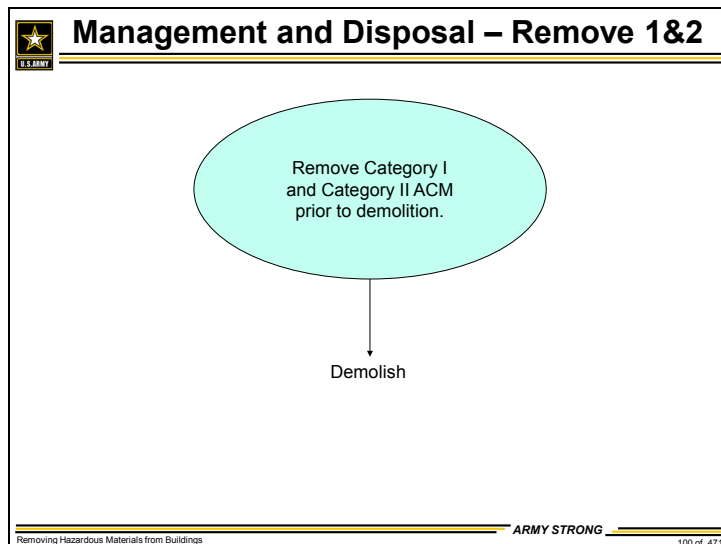


Remember that any materials containing asbestos shall not be recycled and must be disposed of properly in accordance with state and local land-fill regulations.

4.8.6 Heavy equipment use




4.8.7 Other



4.8.8 Removal guidance

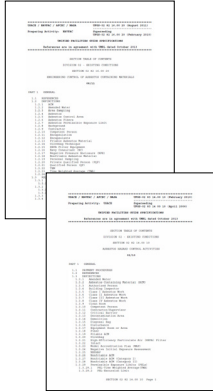
Once the decision is made to remove asbestos, there are several specific physical and procedural requirements per regulation, as interpreted in UFGSs previously referenced (02 82 14.00 10 and 02 82 16.00 20.⁶ Both types of documents have similar content; one is produced by USACE, the other by NAVFAC.

⁶ UFGS are posted on the Whole Building Design Guide website at: http://www.wbdg.org/ccb/browse_cat.php?c=3.




ACM Removal Guidance

- Two Unified Facilities Guide Specifications (UFGS) provide requirements for removing ACM from buildings
 - UFGS 02 82 14.00 10 *Asbestos Hazard Control Activities*
 - UFGS 02 82 16.00 20 *Engineering Control of Asbestos Containing Materials*
 - See: http://www.wbdg.org/ccb/browse_cat.php?c=3




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4.8.8.1 General removal



ACM Removal – General

- General requirements include:
 - Description of the work
 - Medical exam and certification for workers
 - Employee training
 - Permits, licenses, and notification of authorities
 - Environmental safety and health issues:
 - Worker protection
 - Hazard communication, hazard abatement plans
 - Testing laboratory qualifications
 - Others

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The general requirements of a specification include design, regulatory, and administrative requirements for the project. Examples include the following points:

- The person planning the removal project must be licensed by the state (most likely) or the EPA. Workers must be certified per OSHA regulations (29 CFR 1926.1101), relevant to the specific type of job.
- The state environmental agency must be notified prior to project start. Specifics and required lead time will vary.

- The hazards present on-site must be communicated to the workers. Precautions to mitigate exposure must be described to them, as must response procedures in the event that a worker is exposed.
- A qualified, independent laboratory must be selected as a subcontractor to analyze ACM samples.



ACM Removal – General

- General requirements include:
 - Submittals: documentation, sampling and test data, product and equipment data, and other information the contractor provides throughout the project.
 - Contractor quality control measures:
 - Maintaining worker training and qualifications
 - Equipment performance
 - Personal protection
 - Others

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The contractor must submit information to the government throughout the project to ensure that the contractor is conforming to the technical requirements. Some submittals require government review and approval before the work can proceed, while some are required for information only. Examples of submittal requirements may include:



- Proposed work plans
- Ventilation equipment manufacturer's data verifying the appropriate air movement rates and filtration performance.
- Certifications that personnel are trained and qualified
- Laboratory test data and reports
- Other, similar requirements

4.8.8.2 Product removal



ACM Removal – Products

- Product requirements include:
 - Performance and properties for asbestos encapsulants
 - Properties of enclosure materials
 - Performance of equipment and tools



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The largest part of the job will be to remove ACM. Unlike a construction job, little in the way of new materials will become part of the finished work. For those materials that are installed, such as encapsulation systems or coatings, their properties and performance requirements are detailed in the specifications. For those materials that are used for the work and then discarded, such as barrier material and ventilation equipment, their properties are also specified.



The UFGS will list specific criteria for products used on the job site, in reference to OSHA regulations, and ASTM and National Fire Protection Association (NFPA) standards.

4.8.9 Executing removal




ACM Removal – Execution

- Execution requirements include:
 - Respirator performance
 - Protective clothing
 - Eye protection




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The execution requirements comprise the bulk of the ACM removal requirements. Personnel must be protected against asbestos inhalation and contamination. Criteria for respirator performance, protective clothing, eye protection, and other protective measures are detailed in the requirements.



ACM Removal – Execution

- Execution requirements include:
 - Warning signs
 - Labels






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Warning signs must be posted in appropriate on all disposal containers. Examples of warning signage are:


- DANGER
- ASBESTOS

- CANCER AND LUNG DISEASE HAZARD
- AUTHORIZED PERSONNEL ONLY
- RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA



ACM Removal – Execution

- Execution requirements include:
 - Enclosure construction
 - Ventilation equipment
 - Protection of surfaces and areas



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The idea is to keep the work area as small as possible and to keep that area under negative pressure to ensure that no airborne fibers leave the work area. Specific criteria for barrier construction and equipment performance are detailed in the requirements.



ACM Removal – Execution

- Execution requirements include:
 - Sampling procedures
 - Laboratory testing




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Methods to obtain samples, test, and identify asbestos materials are detailed in the requirements.

ACM Removal – Execution

- Execution requirements include:
 - Removal procedures
 - Wetting
 - HEPA vacuuming



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Ideally, all work surfaces are kept wet to limit the fibers becoming airborne. Debris is collected with a High Efficiency Particulate Air (HEPA) vacuum. The filter is fine enough that it catches all material of concern.

[illegible]


After the job is complete but before the containment structure is removed, “clearance” air sampling is done to make sure there are no airborne fibers remaining (or at least, an extremely low concentration).


NIOSH and EPA both provide clearance sampling procedures and criteria.





ACM Removal – Execution

- Disposal:
 - Bagging
 - Labeling
 - Transportation









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The contractor must provide the government's project manager and Contracting Officer with: (1) evidence that the disposal site selected is appropriately permitted by the state, and (2) records of transport to and disposal at that site.


5 Lead-Based Paint (LBP)

This section covers the various issues arising when LBP is present on building surfaces. When LBP is present, various regulations apply to protect building occupants (especially children), workers, and the environment.

LBP has been in the news most frequently in association with low-income housing and/or schools. Regardless of where it is found, it is a hazard and must be managed according to specific requirements.

5.1 Terminology

Terminology is important, because it involves considering regulatory definitions and the number of agencies promulgating the regulations.



Terminology

- Important LBP terms are defined by 4 different Federal agencies:
 - Occupational Safety and Health Administration (OSHA)
 - U.S. Department of Housing and Urban Development (HUD)
 - Environmental Protection Agency (EPA)
 - U.S. Army

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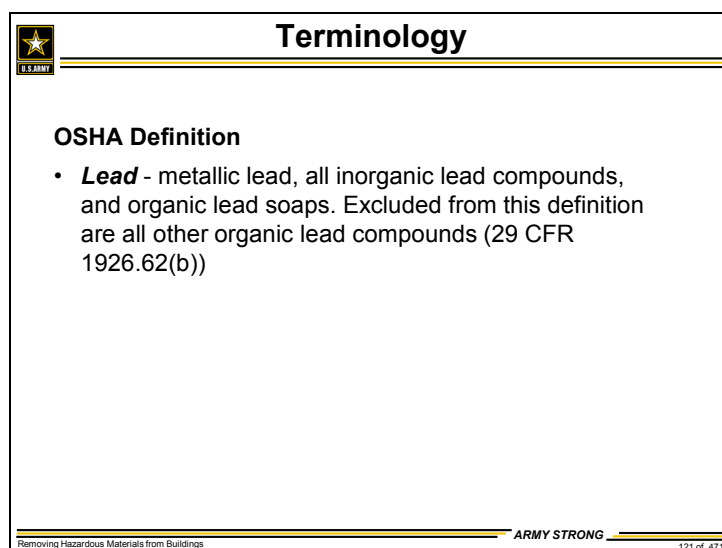
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Each of the four agency definitions will be considered in the subsections that follow.

5.1.1 OSHA definition

OSHA does not explicitly define the phrase “lead-based paint.” Instead, the agency takes a broader view and simply defines the term “lead.”




This definition of lead applies in all construction work where an employee may be occupationally exposed to lead. Construction work includes, but is not limited to, the following activities:

- Demolition or salvage of structures where lead or materials containing lead are present.
- Removal or encapsulation of materials containing lead.
- New construction, alteration, repair, or renovation of structures, substrates, or portions thereof that contain lead, or materials containing lead.
- Installation of products containing lead.
- Lead contamination/emergency cleanup.
- Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed.
- Maintenance operations associated with the construction activities described in the above bullets.

5.1.2 EPA definition

EPA on the other hand, is very specific, although you will notice that its definition of LBP does not specify an actual concentration or amount of lead within the paint itself that makes it “lead-based paint,” only the amount present in the painted surface.



Terminology

EPA Definition

- **Lead Based Paint** –paint or other surface coatings that contains lead equal to or in excess of 1.0 milligram per square centimeter (1.0 mg/cm²) or 0.5% by weight (40 CFR 745).

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But the really tricky aspect of the EPA definition of “lead-based paint” is that it only applies to the management, assessment, and/or removal of LBP in residential housing.

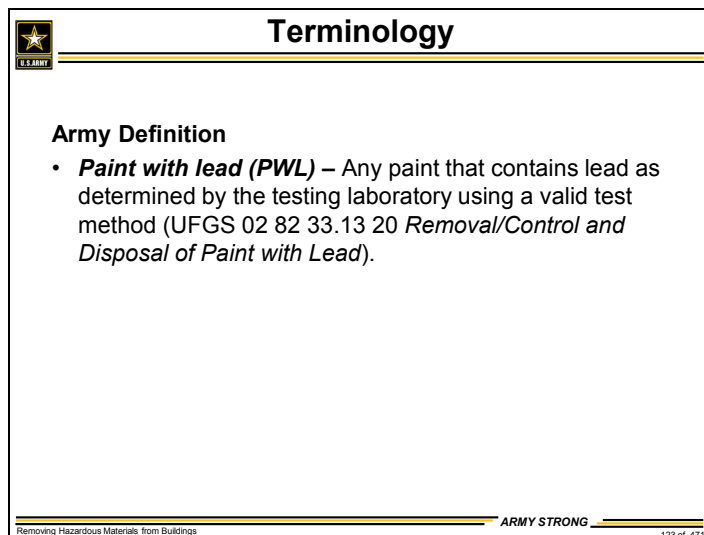
NOTE: The OSHA and EPA measurements are not equivalent!

The OSHA definition is a loading of lead on the surface area, as measured by an x-ray fluorescence (XRF) spectrometer. This value is not affected by what can be many layers of non-lead paint applied over the old LBP.

The EPA definition is lead expressed as a percentage by weight of a dry paint chip. This value is affected by layers of lead-free paint over the LBP.

The different methods for identifying LBP are discussed in subsections that follow in this chapter.

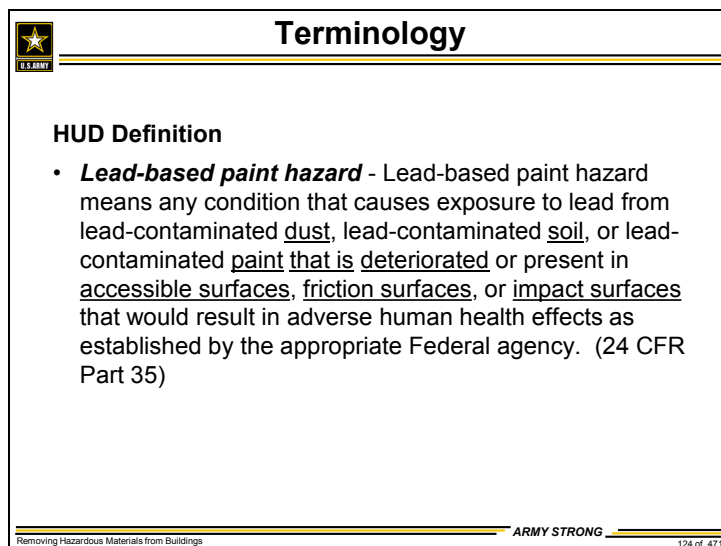
5.1.3 Army definition



The Army definition is one without units or lower limits. The Army uses this terminology in its guidance because OSHA rules apply whenever there is *any* detectable lead present.

The XRF method is used to detect LBP, but it is not sensitive enough to measure paint with lead (PWL). Therefore, a structure can be surveyed with an XRF and be determined to be “lead free,” but smaller amounts of lead present on the surfaces could still trigger exposure levels above an OSHA Action Level.

5.1.4 HUD definition




LBP constitutes a hazard when it is in a form that can enter the body. This situation occurs primarily when lead accumulates in dust or soil, is on accessible surfaces, or is on surfaces that are subject to friction or impact.

Lead paint formulations were oil-based paints, and that type of paint tends to become more and more brittle with age. Friction or impact either releases paint chips or grinds paint into a powder that becomes part of household dust, which is accessible to young children.

5.1.5 Other definitions

EPA has additional terms and phrases to clarify what is meant by a residence.



Terminology

EPA Definitions

- **Residential dwelling** - for LBP this means:
 1. a single family dwelling, including attached structures such as porches and stoops, or
 2. a single family dwelling unit in a structure that contains more than one separate residential dwelling unit, and in which such unit is used or occupied, in whole or in part, as the residence of one or more persons. (40 CFR 745.103)
- **Residential building** - a building containing one or more residential dwellings (40 CFR 745.63)


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5.2 History of use

Lead comes in a variety of forms when used in paint.



History of Use


- Lead carbonate (white lead) - white pigment commonly used in pre-1978 house paint .
- Lead oxide (red lead) - commonly used as primer on steel to prevent corrosion.
- Also used -
 - Lead acetate - commonly used in paint, varnish and other coatings as a drying agent.
 - Gray or blue lead - commonly used on ships for corrosion control
 - Lead chromate – once commonly used in traffic marking paints

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- White lead was commonly used in architectural finishes through the 1950s, which is when titanium dioxide pigments became more widely available. White lead's use declined thereafter, but did not cease until it was banned in 1978.
- Lead acetate was used as a drying agent in small amounts, but note that even clear varnishes can contain lead!
- Red lead was used as a thick, long-lasting, anti-corrosive primer on steel surfaces. The industrial use of red lead primers continued beyond 1978, as the 1978 ban applied only to the residential use of LBP.


In September 1971, U.S. Surgeon General Jesse L. Steinfeld, M.D., wrote in *Pediatrics* magazine:

Lead-based paint was commonly used for interior purposes until the 1940s, when it was largely replaced by titanium-based paint; therefore, children living in dilapidated or obviously deteriorating houses built prior to that time are to be given particular attention.



History of Use

- Prior to the 1950s, master painters preferred LBP for its
 - durability,
 - good adhesion,
 - flexibility, and
 - water resistance.
- Lead pigments made good paint!



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Architectural paints containing white lead were designed to be self-cleaning. The ultraviolet (UV) radiation in sunlight slowly broke down the structure of the paint, releasing a powdery chalk on the surface. As rain washed away the chalk, soil was also removed from the surface.

Where did that lead go? It accumulated around the foundation of the structure. It stays there in the top few inches of soil and doesn't tend to leach deeper. It stays there until the soil is disturbed by other activity.

In 1922, the League of Nations banned white-lead interior paint, but the United States declined to adopt the ban.



History of Use

- **1940s:** Public health investigations in the U.S. report that eating lead paint chips causes physical and neurological disorders, behavior, learning and intelligence problems in children.
- **1971:** Lead-Based Paint Poisoning Prevention Act passed
- **1978:** Lead-based house paint banned from consumer uses at 0.06% lead by weight of dry paint.
- **2008:** Allowable lead level lowered to 0.009%.

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Starting in the 1940s, individual municipalities began limiting the use of LBP in public housing, but the paint was still widely available on the market.

It was not until the late 1950s that paint manufacturers voluntarily reduced the lead content of paint for residential applications. From 1950 until 1960, LBP was used primarily for exterior applications and high-traffic/impact areas (e.g., trim, doors, windows, kitchens, bathrooms).

From 1960 through 1978, the use of LBP was generally limited to exterior applications.


In 1978, the CPSC mandated the reduction of lead in residential use to 0.06% (i.e., 600 ppm).

LBP can still be used in industrial applications such as on bridges, on the inside and outside of steel structures to prevent rust and corrosion, and in shipbuilding and repair; however, it is no longer *widely* manufactured or used for such purposes.




History of Use

- 2011 statistics on LBP in residential structures
 - 35% of all housing units in the United States have lead-based paint.
 - Percentage by age of the structure:
 - Before 1940 – 87%
 - 1940 – 1959 – 69%
 - 1960 – 1977 – 24%




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According to the U.S. Department of Housing and Urban Development (HUD), *American Healthy Homes Survey – Lead and Arsenic Findings*, issued April 2011, LBP is still found in our homes—how much LBP depends on the age of the structure.




History of Use

- LBP is potentially on any building surface painted prior to 1978.
- LBP is most frequently on:
 - Buildings constructed pre-1960
 - Exterior painted surfaces
 - Interior doors, windows, trim
- Also on industrial steel structures such as bridges, tanks, towers



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The 1978 ban did not impact the use of lead paint (red lead primers) on industrial structures in areas inaccessible to the public. Red lead primers were used well into the 1980s on bridges, tanks, towers, and other industrial structures.

5.3 Use by U.S. Army

This section describes how LBP has been used by the Army over the years and where it might be found on installations and in buildings.

5.3.1 Lead metal and compounds



Use By The Army


– Lead metal

- Pipes and plumbing materials
- Solders
- Batteries
- Ammunition
- Fishing weights
- Stained glass

– Lead compounds

- Pigment in paints
- Decorative glazes on ceramics
- Lead-acid batteries
- Gasoline additives
- Cosmetics

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The above lists are sources of lead that someone can potentially come in contact with every day. Virtually everyone has been exposed to lead and

carries lead in their bodies. So, remember that LBP is just part of the picture when we look at reducing exposure to lead.

5.3.2 Housing and child-occupied facilities



Use By the Army

- Housing and child-occupied facilities
 - Monitoring the condition of existing LBP
 - Identifying and mitigating lead hazards
 - Disclosure of information to occupants
- Other facilities – LBP must not be ignored!
 - Repair and renovation that disturbs LBP
 - Demolition and disposal of structures with LBP

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LBP is present on many older buildings. Of particular concern are housing and child-occupied facilities such as child care centers and schools, where the goal is to minimize exposure by reducing lead hazards.

In other buildings, LBP remains a concern when it is going to be disturbed during repair and renovation activities. Care must be taken to protect workers and ensure that cleanup is complete.

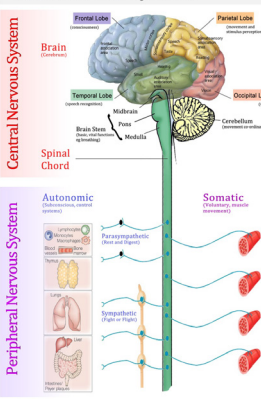
5.4 Health issues

Lead, including lead from paint, can have serious health effects on both children and adults.



Health Issues

The Nervous System



- Lead affects the body in many ways
- In children (especially those under 6 years of age), lead can cause:
 - Brain and central nervous system damage
 - Speech, language and behavior problems
 - Decreased muscle and bone growth
 - Hearing damage
 - Seizures, unconsciousness, and death

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Lead affects the body in many different ways, so the symptoms of lead exposure are often difficult to recognize and to attribute to lead exposure/poisoning. In order for lead to cause harm, it has to be ingested, inhaled, or absorbed through the skin. LBP (containing lead pigment particles) generally does not enter the body through skin absorption, although other forms of lead can pass through the skin. Lead from LBP sources generally enters the body through inhalation or ingestion—someone breathes it in or eats it.


The following are reasons why children at even greater risk to lead exposure than adults:

- Children are rapidly developing and have a developing central nervous system more vulnerable to the effects of lead.
- Children live and play on the floors and ground.
- Children have hand-to-mouth activity that leads to ingestion of more dirt than adults. (They don't care if the cookie was on the floor!)
- Children eat, chew on, or mouth things that they shouldn't (due to exploration, teething, pica, etc.). It has been said that LBP chips have a sweet taste, although the authors cannot personally vouch for that!



Health Issues

- In late 1991, the Secretary of the Department of Health and Human Services called lead the "number one environmental threat to the health of children in the United States."




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In late 1991, the Secretary of the Department of Health and Human Services called lead the “number one environmental threat to the health of children in the United States.” (Alliance to End Childhood Lead Poisoning 1991).

Humans are exposed to lead in many ways. These exposures can be through air, drinking water, food, contaminated soil, deteriorating paint, and dust. Airborne lead enters the body by breathing or swallowing lead particles or dust once it has settled. Old LBP is the most significant source of lead exposure in the United States. Most homes built before 1960 contain heavily leaded paint. Some homes built as recently as 1978 may also contain lead paint.



Health Issues

- In adults, lead can cause:
 - Reproductive harm and damage to the fetus
 - High blood pressure
 - Digestive problems
 - Memory and concentration problems
 - Muscle and joint pain¹
- Exposure is cumulative!


¹US EPA Protect Your Family From Lead in Your Home, September 2013

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Lead affects many of the major systems of the human body. Because exposure is cumulative, it is imperative to protect workers, building occupants, and others from the effects of even low-level exposure that may be repeated over time.



Health Issues


- Workers in certain occupations are at highest risk:
 - Painters
 - Sandblasters
 - Welders
 - Plumbers
- The “do it yourself” crowd that is unaware/unconcerned about LBP.
- Those who enjoy certain hobbies.

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Hobbies associated with lead include:

- fishing (sinkers),
- stained glass,
- lead casting, and
- metalwork

5.5 Regulation



How is it Regulated?


- Regulating agencies:
 - Consumer Products Safety Commission (CPSC)
 - Department of Housing and Urban Development (HUD)
 - OSHA
 - Environmental Protection Agency (EPA)
 - Department of Defense

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As shown above, there are several agencies regulating the manufacture, use, and removal of LBP. Each agency's regulations will be looked in subsections that follow.



How is it Regulated?

- Federal Laws and Executive Orders
 - Lead-Based Paint Poisoning Prevention Act (LBPPPA)
 - Housing and Community Development Act of 1992
 - Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X)
 - Consumer Product Safety Improvement Act (CPSIA) of 2008
 - Resource Conservation and Recovery Act (RCRA), Subpart C

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The LBPPPA was first passed in 1971 and amended in 1973 to address LBP in federally-funded housing. It established definitions for LBP and lead poisoning. The LBPPPA was amended again in 1987–1988 to include an R&D program and also to define intact LBP within the definition of an immediate hazard.

In 1992, the LBPPPA was incorporated as Title X of the Housing and Community Development Act of 1992, and became known as “Title Ten.” The

1992 version of the act put a new twist on how to reduce LBP hazards, and it affected all HUD and other federal housing programs. The results included the following examples of changing viewpoints:

- Emphasizing the prevention of LBP hazards before children are poisoned.
- Shifting the focus away from abating intact LBP to controlling LBP hazards and allowing for new technology for evaluating and reducing those hazards.
- Redefining the concept of LBP hazards to include lead-contaminated dust and soil.
- Acknowledging that some LBP hazards are of more immediate concern than others.
- Recognizing that resources are limited and allowing for the tailoring of LBP hazard programs to fit the financial and environmental conditions of specific properties.

Additionally, Title X required several federal agencies to establish new standards and requirements to aid in identifying and reducing LBP hazards.

At the same time that Title X of the Housing and Community Development Act of 1992 was being issued (aka the LBPPA of 1992), TSCA was amended by the Residential Lead-Based Paint Hazard Reduction Act of 1992. The Residential Lead-Based Paint Hazard Reduction Act of 1992 is particularly important to federal facilities because it specifically stated that federal agencies must comply with all federal, state, interstate, and local requirements (both substantive and procedural) that pertain to LBP, LBP activities, and LBP hazards. The Act also expressly waives any immunity otherwise applicable to the United States, including immunity from penalties and fines levied by the EPA and state agencies (15 USC 2681).

The Residential Lead-based Paint Hazard Reduction Act of 1992 required that potential buyers and renters of housing built prior to 1978 receive certain information about lead and lead hazards in the residence prior to becoming obligated to buy or rent, and provides buyers the opportunity of an independent lead inspection. Sellers, landlords, and agents are responsible for compliance. The enforceable regulations associated with this law, 40 CFR 745, went into effect 6 December 1996.

The Consumer Product Safety Improvement Act (CPSIA) of 2008 lowered the cap on lead content in paint from 0.06% to 0.009%, starting 14 August 2009.

Lastly, and more broadly, lead itself is regulated under RCRA Subtitle C, which is about hazardous waste, because if, as a result of a TCLP test, the lead in the leaching solution is present at a concentration ≥ 5 mg/l (or ppm), the waste would be considered to be hazardous and would be required to be managed as a hazardous waste.

5.5.1 EPA regulations

How is it Regulated?

- EPA Regulations
 - 40 CFR 745, Lead-based Paint Poisoning Prevention in Certain Residential Structures:
 - ❖ Subpart D: Lead-Based Paint Hazards
 - ❖ Subpart E: Residential Property Renovation
 - ❖ Subpart F: Disclosure of Known Lead-Based Paint and/or Lead-Based Paint Hazards Upon Sale or Lease of Residential Property
 - ❖ Subpart L: Lead-Based Paint Activities

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When first issued in 1996, Title 40 CFR Part 745 was called “Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities.” That previous title, in some ways, better reflected the contents than the current title does.

The regulations at 40 CFR 745 have subsections with certain requirements, as listed below:

- Subparts E and L require those engaged in renovation, repair, and painting activities in homes or child-occupied facilities (such as day care centers and kindergartens) built prior to 1978 to be trained and certified in lead-safe work practices and to use those work practices to guard against lead contamination. It also requires that contractors provide information on lead safety prior to beginning work.

- Subpart F addresses the requirements for notifying tenants about potential hazards.

However, none of the regulations require a test for LBP to determine whether notification is necessary. Notification is based on knowledge and assumptions that can be made based on when the home was built/painted. In the past 3–5 years, however, the EPA has become more interested in whether the notification requirements are being met. In 2012, two private-sector companies were charged and convicted of failing on multiple occasions to notify prospective tenants, including families with young children, about potential lead paint hazards in housing managed by the companies on the two Navy bases in New England. The two companies reached a settlement agreement for a penalty of \$89,300.⁷

In January of 2001, 40 CFR 745 was amended to answer the questions which had arisen from the rash of LBP activities resulting from the 1996 rule. The biggest questions were what to do with the lead dust residue and what to do about the soil surrounding exterior areas where LBP was removed.


It could be argued that because these regulations apply to residences and the Army has off-loaded the management of its residences to private companies (for the most part), why should installation personnel be concerned with 40 CFR 745? Answers to that question include the following reasons:

- Some installations do still own and operate residential housing.
- More installations have child care and/or day care activities occurring in federal buildings, and these regulations apply to child-occupied facilities, which are defined as “a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under 6 years of age, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours.

⁷ <http://yosemite.epa.gov/opa/admpress.nsf/ab2d81eb088f4a7e85257359003f5339/5d3d6abb51575ee7852579f10069ca7e!OpenDocument&Highlight=2.lead>

- Child-occupied facilities may include, but are not limited to, day care centers, preschools, and kindergarten classrooms.
 - Child-occupied facilities may be located in target housing or in public or commercial buildings.
 - With respect to common areas in public or commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only those common areas that are routinely used by children under age 6 years, such as restrooms and cafeterias. Common areas that children under age 6 only pass through, such as hallways, stairways, and garages, are not included.
 - In addition, with respect to exteriors of public or commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only the exterior sides of the building that are immediately adjacent to the child-occupied facility or the common areas routinely used by children under age 6 years.
- 40 CFR 745 has been a template for state regulations that have expanded the applicability to nonresidential buildings because of concerns about improper disposal of lead-contaminated debris and/or fugitive emissions of lead dust to the atmosphere.

5.5.2 OSHA regulations



How is it Regulated?

- OSHA Regulations:
 - 29 CFR 1926.62 LEAD - covers lead exposure during construction work, including alteration, repair, renovation, and demolition of structures containing lead
 - 29 CFR 1910.1025 covers lead exposure except those covered by other parts of Title 29
 - 29 CFR 1915.1025 covers lead exposure when working in shipyards
 - 29 CFR 1928 covers lead exposure in the agricultural industry

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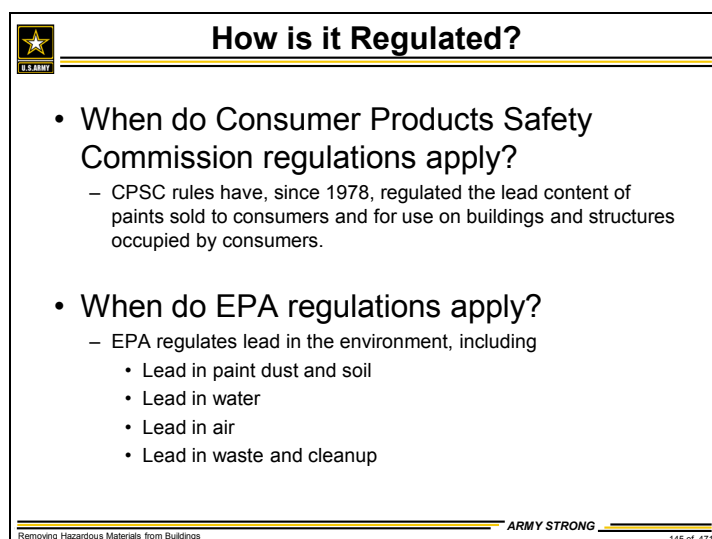
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Note that the OSHA rules apply when lead is present. There is no minimum amount of lead in paint specified. Instead, the amount of lead in the workers breathing zone is what is important here.

The paint does not have to meet a definition of LBP or lead-containing paint. If lead is present, workers are to be protected until testing shows that levels do not exceed the action level (defined in 29 CFR 1926.62) of 30 ug/m³ of airborne lead in the breathing zone of the worker, calculated as a time-weighted average.

If the lead is present in a paint, even below the levels that define it as LBP, working with that paint can still cause a worker to be exposed at a level exceeding the action level. One example is dry sanding a painted surface in a confined area, generating a lot of airborne dust containing lead.

5.5.3 Consumer Products Safety Commission



How is it Regulated?

- When do Consumer Products Safety Commission regulations apply?
 - CPSC rules have, since 1978, regulated the lead content of paints sold to consumers and for use on buildings and structures occupied by consumers.
- When do EPA regulations apply?
 - EPA regulates lead in the environment, including
 - Lead in paint dust and soil
 - Lead in water
 - Lead in air
 - Lead in waste and cleanup

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In 1978, CPSC limited the allowable level of lead in paint to 0.06% by weight of the dry paint. In 2009, the level was further reduced to 0.09%.

The CPSC rules for the allowable level for lead in paint apply to:

- paints sold to consumers
- paints on consumer items such as toys and furniture, and
- paints applied to residences, schools, hospitals, parks, playgrounds and other areas accessible to consumers.

The question could be asked as to why the CPSC's allowable level was not set at zero? The answer is because lead is a naturally occurring element in the earth's crust, and many pigments (e.g., zinc, titanium dioxide, iron oxide, talc) are mined from the earth and naturally contain small amounts of

lead. The levels established by CPSC are achievable and still protect consumers.

Everyone who grew up in a home built before 1978 and younger people living in older homes have potentially been exposed to lead from residential LBP. In fact, everyone has been exposed to lead from one environmental source or another.

EPA rules apply whenever LBP activities can generate wastes or redistribute lead in water, air, or soil.

How is it Regulated?

- When do OSHA regulations apply?
 - Whenever there is a potential for worker exposure to lead.
- When do HUD regulations Apply?
 - HUD sets standards for evaluation and management of lead in federally assisted housing and promotes efforts to reduce lead hazards in privately owned housing.

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As shown above, OSHA regulations apply whenever workers have the potential to be exposed to lead.

In addition to the roles listed above, HUD oversees grant programs, cooperative agreements, and policy issues. Grant programs include technical studies to gain knowledge on improving the efficacy and cost-effectiveness of methods for evaluation and control of residential LBP hazards.

These agencies work together through the Federal Interagency Lead-Based Paint Task Force to exchange information and coordinate activities.

In considering all applications, it should be remembered that there are likely to be state and local regulations that are more stringent than the federal laws and regulations. Again, where you generally see more stringent state regulations is as an expansion of the LBP testing/sampling, work practice, and abatement requirements to nonresidential buildings.

5.5.4 Army regulations




How is it Regulated?

- Army ACSIM Memorandum: *Lead-Based Paint Policy Guidance*, 28 April 1997
- Army ACSIM Memorandum: *Policy Guidance – Lead-Based Paint and Asbestos in Army Properties Affected by Base Realignment and Closure*, 5 November 1997

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Army policy and the associated guidance apply at every Army installation.



How Is It Regulated?


- Public Works Technical Bulletin 420-70-2 *Installation Lead Hazard Management*, 20 February 1997
 - Provides technical guidance to identify and control lead hazards in Army owned or leased target housing and child-occupied facilities.

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This PWTB provided specific guidance on dealing with LBP in Army family housing and also in day-care centers and schools.

5.6 Detection

This discussion will cover how to detect LBP and how to determine whether paint is lead-based.



Detection

- For housing and child-occupied facilities, lead inspections must be done by an a **certified inspector or risk assessor** (40 CFR Part 745).
- Allowed Methods
 - X-Ray Fluorescence spectrometer (non-destructive, requires a licensed operator)
 - Lab testing of paint samples by a laboratory certified by EPA's National Lead Laboratory Accreditation Program (NLLAP) (destructive, requiring surface repair)


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XRF measures lead loading on the surface in units of milligrams per square centimeter, where 1.0 mg/cm^2 is one definition of LBP. The units of milligrams per square centimeter are not dependent on the number of coats of lead-free paint applied over the older LBP. The XRF method is associated with radiation safety issues.

Paint chip samples must be carefully collected by the trained inspector/risk assessor. He or she will collect a sample that includes all layers of paint down to the substrate, but will avoid collecting any significant amount of the substrate with the sample. If the area is carefully checked, this sample can be used to calculate lead loading in the same units of milligrams per square centimeter. Otherwise, the sample can be weighed and lead calculated as a percentage by weight, where 0.5 % is considered LBP. The units of milligrams per square centimeter are preferred. The units are cannot be converted from one to another, due to variations in thickness and composition of paint layers.



Detection

- Chemical spot test kits
 - EPA did not find them to be sufficiently reliable for use in LBP inspections. (EPA 1995)
 - When used by a trained professional, they may be reliable as a negative screen. (NIST 2000)
 - Test kits recognized by the EPA after 1 September 2010 can be used to meet both the negative and positive response criteria for renovation and repair rule. (40 CFR 745.88(b)(4) and (c)).

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The above test kit information is taken from the *HUD LBP Guidelines*, Second Edition, Chapter 7, “Lead-Based Paint Inspection” (HUD 2012).

Spot test kits are useful for a quick and inexpensive confirmation that lead is present, but any questionable results may need to be confirmed with XRF or laboratory analysis.

5.7 Demolition and repurposing concerns


LBP must be addressed when demolishing buildings and when an existing building is being repurposed or converted to another function or occupancy. This section will look at the impact of LBP on the demolition of a building with extensive LBP.

5.7.1 Contract to demolish




Demolition and Repurposing Concerns

- Scenario 1: Contract to Demolish Building
 - Building is NOT a residence or child-occupied facility
 - Building DOES contain extensive paint with lead in excess of 1.0 milligrams per cm² or 0.5% by weight



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Remember that OSHA regulations apply when lead is present, even if it is not enough to cause the paint to meet the definition of LBP.




Demolition and Repurposing Concerns

- Scenario 1 (cont.)
 - This work is not considered a lead-based paint hazard abatement action.
 - However, appropriate precautions must be taken for:
 - Worker protection
 - Waste control, characterization and disposal
 - Leaving the site clean after work

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Note that this work does not involve housing or child-occupied facilities, but OSHA and EPA regulations do apply.

**Demolition and Repurposing Concerns**

- Scenario 1 (cont.)
 - Consult
 - UFGS 02 83 13.00 20 *Lead in Construction*, and
 - UFGS 02 82 33.13 20 *Removal/Control and Disposal of Paint with Lead*

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This work is likely to be done under contract, and the guide specifications listed above provide the guidance needed to properly account for LBP in the work. These UFGSs will be covered in more detail later in this chapter.


**Demolition and Repurposing Concerns**

- Scenario 1 (cont.)
 - The contractor doing this work must comply with OSHA 29 CFR 1926.62.
 - Waste must be properly characterized and disposed.
 - Baseline and post-work wipe and/or soil sampling may be required to assess degree of contamination.

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The key regulation here is 29 CFR 1926.62 *Lead in Construction*, as previously discussed.

Baseline testing of both dust (e.g., wipe samples) and soil protect both the government and the contractor. Requirements for doing wipe sampling are well defined in the work procedures listed in 29 CFR 1926.62.


**Demolition and Repurposing Concerns**

- Scenario 1 (cont.)
 - Contractor Submittals
 - Occupational and Environmental Assessment Data Report
 - Lead Compliance Plan
 - Qualifications of the designated "Competent Person"
 - Training Certification of workers and supervisors
 - Lead Waste Management Plan
 - Certification of Medical Examinations for workers
 - Closeout submittals (waste manifests, etc.)

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The contractor is required to submit the following as part of the work:

- Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment)
- Lead Compliance Plan with competent person (CP) approval including signature, date, and certification number
- CP's qualifications (in accordance with OSHA 29 CFR 1926.62)
- Training certifications for workers and supervisors
- Lead Waste Management Plan
- Written evidence that TSD (treatment, storage or disposal) facility is approved for lead disposal
- Certification of medical examinations


**Demolition and Repurposing Concerns**

- Scenario 1 (cont.)
 - Waste disposal from a nonresidential building:
 - The "generator" of the waste must determine whether or not it is hazardous waste.
 - Who is the generator - the installation or the contractor removing the waste?
 - In the majority of situations, the "generator" is the installation.

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Note that the “generator” is the installation in most cases, so it is ultimately responsible for the waste for cradle to grave.

5.7.2 Renovation and Repair Program



Demolition and Repurposing Concerns


- Renovation and Repair Program
 - Requires that those engaged in renovation and repair activities in homes or child-occupied facilities built prior to 1978 be:
 - trained and certified in lead-safe work practices, and
 - use these work practices to guard against lead contamination.

(40 CFR Part 745, Subpart E Residential Property Renovation)

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5.7.3 Training and Certification Program



Demolition and Repurposing Concerns


- Training and Certification Program
 - Requires that those engaged in **lead abatements, risk assessments** and inspections in homes or child-occupied facilities built prior to 1978 be trained and certified in specific practices to ensure accuracy and safety.

(40 CFR Part 745, Subpart E Residential Property Renovation)

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5.7.4 Residential LBP Disclosure Program


**Demolition and Repurposing Concerns**

- Residential Lead-based Paint Disclosure Program
 - This requires that potential buyers and renters of housing built prior to 1978 receive certain information about lead and lead hazards in the residence prior to becoming obligated to buy or rent, and provides the opportunity for an independent lead inspection for buyers.

(40 CFR Part 745 Subpart F)

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5.7.5 OSHA Lead in Construction Rule

**Demolition and Repurposing Concerns**

- OSHA Lead in Construction Rule
 - 29 CFR Part 1926.62 – June 1993
 - Applies to all construction work where an employee may be exposed to lead
 - Sets no lower limit on lead levels on the work surface – “detectable” lead is enough

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The OSHA construction industry standard (29 CFR 1926.62, Lead) has been in effect since 1993, and OSHA had it in their Special Emphasis Program during its first 6 years. There have been numerous inspections under it.


The following points highlight parts of the rule and some of the areas where compliance problems have been noted. The scope of the rule is basically that all construction trade activities where an employee may be occupationally exposed to lead. Specifically, the scope includes:

- Demolition and salvage of structures
- Removal or encapsulation of lead-containing materials
- New construction, renovation, or repair activities
- Installation of new materials
- Lead emergency cleanup
- Transportation, disposal, or storage activities associated with construction
- Maintenance operations associated with the above

There is no minimum lead concentration in materials that puts this rule in effect. Indeed, very low levels of lead can lead to exposure at the action level or PEL.

Exposure assessment is the biggest problem noted in OSHA inspections. Each situation must be monitored whenever there is a change in location, people, practices, or equipment. Workers must be protected during assessment, treated as if they were exposed above the PEL, and given respiratory protection. After assessment confirms that the PEL is not exceeded, the worker protection can then be readjusted to fit the conditions.

Historical data is allowed, but the contractor must be able to prove that the conditions between different structures are identical. This proof may be practical in cases of a group of family housing structures that have the same construction and identical painting histories, but these cases are rare.

**Demolition and Repurposing Concerns**


- OSHA Lead in Construction Rule
 - Action level – 30 $\mu\text{g}/\text{m}^3$ as an 8-hour time-weighted average (TWA)
 - Permissible exposure limit - 50 $\mu\text{g}/\text{m}^3$ as an 8-hour TWA

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Two definitions should be noted:

- *Action level* means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air ($30 \mu\text{g}/\text{m}^3$) calculated as an 8-hour time weighted average (TWA).
- *Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions, and who has authorization to take prompt and corrective measures to eliminate them.

The PEL for lead is $50 \mu\text{g}/\text{m}^3$ for an 8-hour period. This limit is based on the concentration of lead in the breathing air of the employee. An employee will be exposed to no level higher than this based on an 8-hour work period. A longer workday will reduce this limit, and a shorter workday will increase it.



Demolition and Repurposing Concerns

- OSHA Lead in Construction Rule methods of compliance
 - Engineering and work practice controls (to reduce exposure as low as feasible)
 - Written compliance program, including
 - Description of each activity
 - Description of specific means to achieve compliance
 - Air monitoring data
 - Work practice program
 - Other relevant information

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Methods of compliance with OSHA construction industry standard - 29 CFR 1926.62 are:

- engineering and work practice controls,
- compliance program,
- mechanical ventilation, and
- administrative controls.

Wherever possible, work practice controls must be employed to reduce and maintain employee exposure below the PEL. These controls includes choosing methods of paint removal that generate less airborne lead, mechanical ventilation, etc.

A written compliance program is required prior to commencement of the job. The written compliance program shall provide for frequent and regular inspections of job sites, materials, and equipment to be made by the competent person.

**Demolition and Repurposing Concerns**

- OSHA Lead in Construction Rule methods of compliance (cont.)
 - Mechanical ventilation
 - Performance evaluated as necessary to maintain effectiveness
 - Administrative controls
 - Job rotation schedule to reduce daily exposure time for an individual

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Worker PELs are based on an 8-hour time-weighted average. That exposure can be reduced by work practice controls such as mechanical ventilation, or by reducing the amount of time the worker spends in the area where lead is in the air.

Examples of administrative controls include a job rotation schedule. Where engineering controls cannot sufficiently keep exposure below the PEL, then respiratory protection will be added to supplement.

The lead exposure associated with different activities varies greatly, as shown below.

Demolition and Repurposing Concerns

- Construction activity exposure levels ($\mu\text{g} / \text{m}^3$) (50 is the PEL)
- Open abrasive blasting 17,000
- Blasting in containment 27,000
- Hand scraping 96
- Spray applying LBP 74


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Abrasive blasting out in the open (no longer allowed) is typically associated with 17,000 $\mu\text{g}/\text{m}^3$ of lead in breathing air. To protect the environment, that worker is now put in an enclosure to contain the lead. However, the worker's potential exposure is much higher within the enclosure. Even hand scraping lead from a surface can yield exposure above the PEL. Applying LBP with spray equipment could as well, although this also is not done anymore.

5.7.6 Replacing residential windows and doors

Demolition and Repurposing Concerns


- Scenario 2 – replacing residential windows and doors
 - Child-occupied facility
 - Lead on doors, windows, and adjacent walls is lead-based paint (with lead in excess of 1.0 milligrams per cm^2 or 0.5% by weight).



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This scenario involves a child-occupied facility, which may be either housing, a school, or a child-care center. As part of a building renovation, old

windows are being removed and replaced with new, more energy-efficient windows. The old windows have high levels of LBP.


**Demolition and Repurposing Concerns**

- Scenario 2 (cont.)
 - Consult UFGS 02 83 19.00 10 *Lead Based Paint Hazard Abatement, Target Housing and Child Occupied Facilities*
 - It is required that the specification editor has appropriate training regarding leads-based paint activities. Certification as a project designer per 40 CFR 745 is required.

EPA Lead Renovation, Repair and Painting Rule, April 22, 2008

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As shown above, guidance is available to execute this work properly under a contract (UFGS 02 83 19.00 10). Note that the *specification editor* must be certified as a LBP abatement project designer.

**Demolition and Repurposing Concerns**

- Scenario 2 (cont.)
 - In addition to worker protection and waste requirements previously mentioned, this project has
 - Dust wipe sampling and analysis
 - Clearance monitoring
 - Additional personnel responsibilities and qualifications
 - Occupant notification requirements

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OSHA and EPA regulations apply, just as they did with the demolition scenario. But with a child-occupied facility, there are additional requirements designed to protect the children from LBP hazards, as shown below.


**Demolition and Repurposing Concerns**

- Scenario 2 (cont.)
 - Contractor must be qualified as a Lead-Safe Certified Firm
 - Certification is also required for:
 - Abatement supervisor
 - Lead hazard abatement workers
 - Risk assessor (performs clearance sampling, analysis of data, and reporting)

EPA Lead Renovation, Repair and Painting Rule, April 22, 2008

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Note that the Renovation, Repair and Painting (RRP) Rule requires the firm conducting the work to be certified under 40 CFR 745 Subpart E.

**Demolition and Repurposing Concerns**

- Scenario 2 (cont.)
 - Submittals/Requirements
 - Occupant Protection Plan
 - Qualification as Organization Report
 - Abatement Report
 - Certification of Visual Inspection

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UFGS 02 83 19.00 10 requires appropriate submittals, including a plan to protect the occupants by avoiding the spread of lead contamination and ensuring that cleanup of the work area is complete.

**Demolition and Repurposing Concerns**

- Scenario 2 (cont.)
 - In order to reduce lead poisoning and promote efforts to reduce lead in and around homes, EPA has determined that contractors can manage residential lead-based paint as a household waste.
 - As such, they are excluded from the RCRA Subtitle C hazardous waste regulations, effective July 31, 2000.

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One notable difference between work in a child-occupied structure and other facilities is that LBP waste may be disposed as ordinary household waste. This decision by the EPA helps to promote efforts to reduce childhood exposure to lead in and around homes.

**Demolition and Repurposing Concerns**

- Scenario 2 (cont.)
 - “residential lead-based paint waste” may go to a construction and demolition (C&D) landfill or a municipal solid waste landfill (MSWLF)


<http://www.epa.gov/osw/hazard/tsd/lead/faq.htm>

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This rule applies to residential LBP waste from abatement, rehabilitation, renovation, or remodeling in homes, residences, and other households. “Household” means single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas. Individuals and firms who create residential


LBP waste, such as contractors and do-it-yourselfers, may dispose of LBP waste from these households at C&D landfills.⁸

5.7.7 If contractor ignores LBP




Demolition and Repurposing Concerns

- Scenario 3 – Ignore the LBP
 - In 2011, “Joe Painter”, was contracted to paint the exterior of a 1910 child-occupied residence in Nebraska. He accepted the work and proceeded without regard to the presence of LBP.
 - His work violated the:
 - Toxic Substances Control Act
 - Residential Lead-Based Paint Hazard Reduction Act
 - Renovation Repair, and Painting Rule



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This case was listed as a recent EPA enforcement action not associated with an Army installation, but it is an example of many homeowners’ experiences. The RRP rule is being enforced by the EPA!



Demolition and Repurposing Concerns

- Specifically, “Joe Painter” failed to:
 - Obtain certification for his business
 - Assign a certified renovator
 - Post signs defining the work area and warning occupants
 - Cover the ground with plastic sheeting or impermeable material
 - Provide the owner with the Lead Hazard Pamphlet
- Joe paid a civil penalty of \$3,465

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The painter who accepted the work on this old home paid civil penalties of nearly \$3,500 for proceeding with the work in an ordinary way, without


⁸ http://www.epa.gov/osw/nonhaz/municipal/landfill/lbp_fs.pdf

regard to protection of the family. The work should have gone to a certified “lead safe” painting firm.

5.8 Management and disposal

Once paint or painted materials are removed, they must be disposed of. This discussion covers how paint residue and painted materials are properly handled and disposed of.

5.8.1 Army guidance



Management and Disposal

- PWTB 420-70-2, Installation Lead Hazard Management
 - Provides guidance for:
 - Establishing a Lead Hazard Management Strategy
 - Implementing a Lead Hazard Management Program
 - In order to assist installations to:
 - Comply with applicable Army, Federal, state and local regulations.
 - Identify, control, and abate sources of lead and lead hazards.

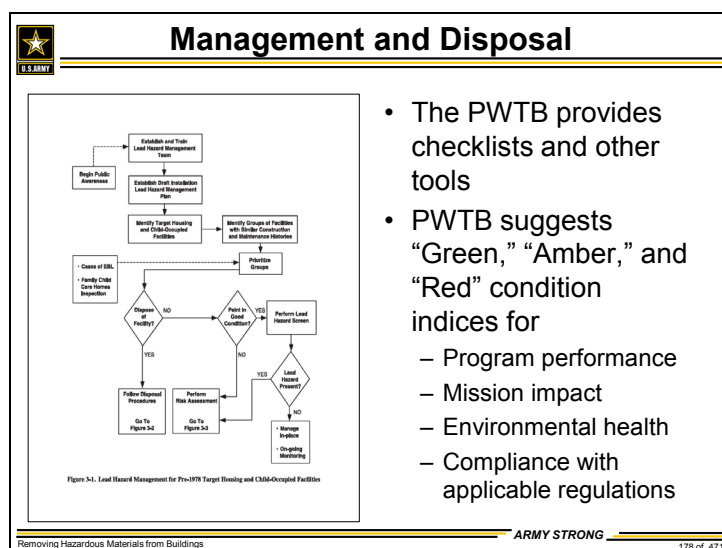
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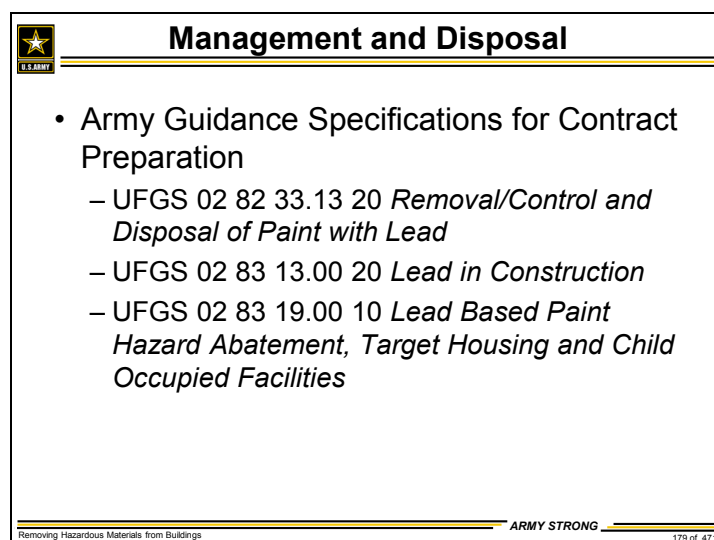
PWTB 420-70-2 was written in 1997 with the purpose of providing technical guidance to identify and control lead hazards from lead-contaminated paint, dust, and soil, and from other sources in Army-owned or -leased target housing and child-occupied facilities constructed prior to 1978, or as required by final governing standards.

The PWTB also helps an installation assess the performance of its lead hazard management program.



- The PWTB provides checklists and other tools
- PWTB suggests “Green,” “Amber,” and “Red” condition indices for
 - Program performance
 - Mission impact
 - Environmental health
 - Compliance with applicable regulations


The PWTB suggests using green-amber-red condition indices, as shown above.



When work is to be done on properties where paint contains lead, the work will generally be performed by contractors. In some cases, the contractor must be EPA- or state-certified, and workers must follow specific work practices to prevent the spread of lead contamination.

The guide specifications listed above cover the requirements for working with lead and help project designers prepare contracts that are in compliance with the complex rules.


Each guide’s details are shown by the slides reproduced below.



Management and Disposal

- UFGS 02 82 33.13 20: *Removal/Control and Disposal of Paint with Lead*
 - This guide specification covers the requirements for limiting occupational and environmental exposure to lead when removing/controlling lead-based paint or paint with lead (LBP/PWL).


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Management and Disposal

- UFGS 02 83 13.00 20: *Lead in Construction*
 - This guide specification covers the requirements for protection of workers, disposal of lead painted material.
 - Also provides guidelines/recommendations for cleanup of lead on construction projects impacting material containing lead and/or lead based paint.
 - Does not apply to abatement of lead hazards in target housing or child-occupied facilities.

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Management and Disposal

- UFGS 02 83 19.00 10: *Lead Based Paint Hazard Abatement, Target Housing and Child-Occupied Facilities*
 - This guide specification covers the requirements for abatement of lead based paint hazards in target housing and child-occupied facilities.
 - Use in conjunction with UFGS 02 83 13.00 20: *Lead in Construction*

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The three guide specifications outlined above are kept up to date as regulations evolve, and provide excellent guidance for writing proper contracts for the work.

5.8.2 Characterization of waste



Management and Disposal

- Hazardous Waste Characterization
 - Option 1: Generator knowledge
 - Make a determination based on existing knowledge of the amounts and concentration of LBP present and say it is or is not hazardous waste.
 - Option 2: Laboratory testing
 - Submit a representative sample for toxicity characteristic testing
 - Waste is hazardous if results show lead at or above the regulatory level of 5.0 mg/L
(40 CFR Part 261)

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Generators are not required to perform analytical testing to identify their wastes. They are, however, required to accurately characterize their wastes. This means they may make a hazardous waste determination by testing or applying their knowledge of the waste's chemical and physical properties as specified in 40 CFR Part 261 §262.11 (e.g., knowledge of the process, inputs, reactions, or operating status for the day).


From 40 CFR Part 261:

(xi) Nonhazardous waste determinations must be conducted annually to verify that the wastes remain nonhazardous.

(A) The annual testing requirements are suspended after three consecutive successful annual demonstrations that the wastes are nonhazardous. The generator can then use knowledge of the wastes to support subsequent annual determinations.


(B) The annual testing requirements are reinstated if the manufacturing or waste treatment processes generating the wastes are significantly altered, resulting in an increase of the potential for the wastes to exceed the listing levels.

(C) If the annual testing requirements are suspended, the generator must keep records of the process knowledge information used to support a nonhazardous determination. If testing is reinstated, a description of the process change must be retained.




Management and Disposal

- For hazardous waste determinations, collect samples from drums, roll offs, and containers that are representative of the waste and submit for laboratory testing. (40 CFR Part 261)



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There are many ways to sample a dumpster full of debris. An effort must be made to obtain a small sample that still represents the whole of the waste, and the procedure used must be documented. Choosing samples that have a higher concentration of LBP can cause higher waste disposal fees than are required. Conversely, avoiding LBP in the sample can lead to improper disposal that results in penalties and fines. Remember, the government is usually considered to be the hazardous waste generator, regardless of who is doing the actual work.




Management and Disposal

- If It is Hazardous Waste...
 - Ensure that the installation hazardous waste manager is aware of the project and monitors the handling of the waste.

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There are proper procedures for handling, transporting, disposing, and documenting hazardous wastes. Be sure to follow them!



Management and Disposal

- Be aware that local requirements may be substantially more restrictive for the conduct of LBP or LBP hazard abatement projects.

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Note that all rules covered in this curriculum are subject to change, and they can be made even stricter because of added state and local regulations. It is important to be aware of local regulations and always be prudent in all matters pertaining to the handling of LBP.

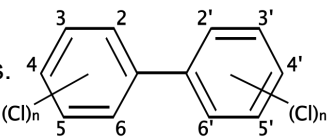
6 Polychlorinated Biphenyls (PCBs)

6.1 Terminology



Terminology


- Polychlorinated biphenyls – PCBs
- Chlorinated organic compounds
- 209 different congeners – *different properties*
- Marketed under the trade name **Aroclor**
- Aroclor 1260
 - 12 carbon atoms
 - 60% chlorine by mass.



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Aroclor™ was Monsanto's brand name for PCBs, and the most common brand used in the United States. Aroclor 1254 and 1260 were the most congeners sold, and they were used in paints and plasticizers. Note that the higher the chlorine atom number, the higher the viscosity of the oil.

6.2 History of use



History of Use

- 1881: German chemists synthesized the first PCBs in a laboratory.
- 1914: Enough PCBs had already escaped into the environment to leave measurable amounts in the feathers of birds held in museums today.
- 1937: Reports of health problems associated with PCBs are documented in the Journal of Industrial Hygiene and Toxicology and at a Harvard Public Health Conference.
- 1977: EPA issues effluent standards for PCBs.
- 1 Jan 1979: Ban on manufacture/importation of PCBs.
- 31 May 1979 Regulations on manufacture, processing, distribution in commerce, and use of PCBs are finalized.

NOTE: PCBs are still in use!

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When first synthesized, PCBs were thought to be “liquid gold” by researchers because the new product was far safer than flammable mineral oil.


Mineral oil had become a common source of fire during the growing industrialization of Europe and the United States.

The early use of PCBs was so widespread that an analysis conducted on birds collected prior to 1914 evidenced PCBs (Riseborough and Brodine 1971, 243–255).

Even though the health effects of PCBs were documented as early as 1937 and continued to be documented and reported throughout the 1940s, 1950s, and 1960s, a ban on the manufacture of PCBs in the United States was not enacted until much later.

Under the TSCA, the manufacture and importation of PCBs was banned after 1 January 1979. But even the ban had one caveat: if an importer had received an exemption from EPA, they could continue to import PCBs. To no one's surprise, the caveat generated a number of court cases on behalf of importers who had applied for an exemption prior to 1 January 1979 but had not yet received judgment from the EPA. After the dust settled, the bottom line is that in order to import PCBs into the United States, the importer has to have received an exemption from the EPA based on the finding that no unreasonable risk of injury to health or the environment would occur.

Finally, on 31 May 1979, the first enforceable regulations were finalized, and they attempted to address everything concerning PCBs.



History of Use

- Manufactured by:
 - ***Anniston Ordnance Company,***
1927
 - ***Swann Chemical Company***
1930
 - ***Monsanto Industrial Chemical***
1935-1977
- Sauget, Illinois; Anniston, Alabama
- Production peak - **1970**

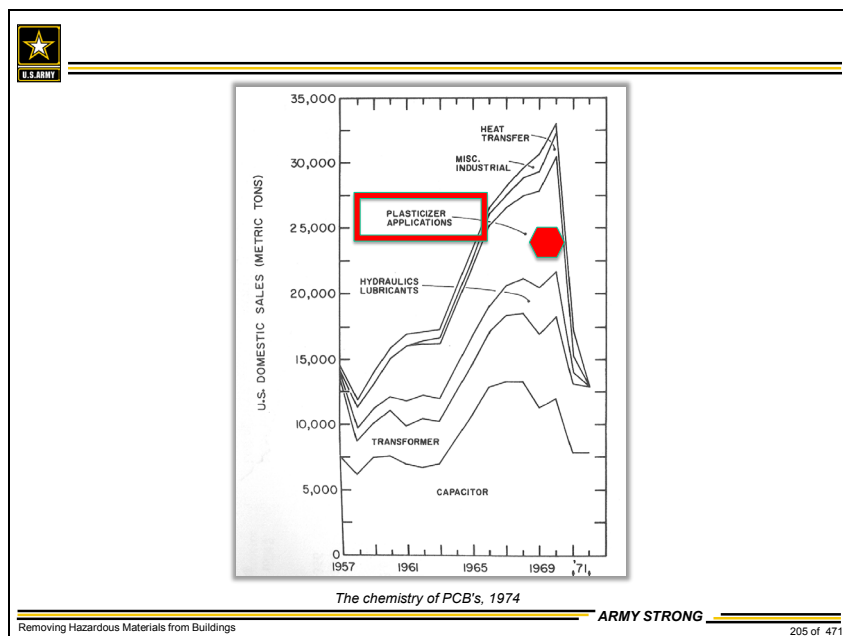
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Note that the production peak for all uses occurred in 1970, so construction materials with PCBs were still commercially available a few years past the peak year.

Buildings maintained and/or painted within the time window of 1955 to 1975 are very suspect for having used PCB-containing materials.



PCB use is usually considered to be in transformers and electrical equipment, but one-third to one-fourth of PCB production was for plasticizer applications such as those used in paint and caulk.




History of Use

Currently Authorized Uses of PCBs

Transformers	Authorized use at any concentration though restrictions and regulatory requirements increase with higher PCB concentration thresholds.
Railroad Transformers	Transformers used in locomotives and self-propelled railcars. Authorized use at < 1,000 ppm; < 50 ppm if transformer coil is removed at any time.
Heat transfer systems, hydraulic systems, mining equipment	Authorized use at < 50 ppm
Natural gas pipelines	Authorized at < 50 ppm, or at > 50 ppm with additional requirements. PCBs may be present in natural gas compressors, scrubbers, filters, and in condensate.
Research & Development	Authorized primarily for purposes relating to environmental analysis, management, and disposal of PCBs. R&D for PCB products is prohibited.
Scientific Instruments	Examples include oscillatory flow birefringence & viscoelasticity instruments for the study of the physical properties of polymers, microscopy mounting fluids, microscopy immersion oil, and optical liquids.
Carbonless copy paper	Use of existing carbonless copy paper is permitted; manufacturing of new carbonless copy paper is not authorized.
Electromagnets, switches, voltage regulators, circuit breakers, reclosers, cable	No restrictions on existing use; restrictions on PCB concentrations if serviced and oil is removed or replaced.
Porous surfaces	EPA considers building materials, such as concrete, porous with respect to PCB leaks and spills. Porous building materials may be left in place following spills provided various conditions are met. Older industrial machinery often was designed to slowly leak (PCB-containing) hydraulic oil as a lubricant.

Source: EPA (2002)


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PCBs can still be used in very limited circumstances, as illustrated by the above list from EPA.


6.3 Use by U.S. Army



Use by the Army


- Any of these products (if manufactured before 1979):
 - Waste or debris from the demolition of buildings and equipment manufactured, serviced, or coated with PCBs.
 - Waste containing PCBs from spills such as floors or walls contaminated by a leaking transformer.

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Originally the EPA's regulations were developed to go with the use, testing, and disposal of PCBs in electrical equipment. As additional sources of PCBs are identified, the regulations are adapting to include those sources. (See Section 6.5 for further discussion of PCB regulations.)



Use By The Army

- Plastics
- Molded rubber parts
- Applied dried paints
- Oil-based paints
- Coatings and sealants
- Caulking
- Adhesives and tapes
- Carbonless copy paper
- Galbestos
- Sound-deadening materials
- Insulation




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The above list shows the many non-electrical uses of PCBs, accounting for perhaps one-third of total PCB use.


6.4 Health issues

The International Agency for Research on Cancer and the EPA classify PCBs as a *probable* human carcinogen. Other international organizations classify PCBs as *definite* carcinogens.



Health Issues

- Probable human carcinogens
- Negative effects on the immune system, the reproductive system, the nervous system, and the endocrine system



PCB exposure causes bird deformities like the crossed bill in this cormorant.

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The following points about PCB exposure and health effects are taken from Gabrio et al. 2000 and Rudel et al. 2008.

The effects of PCB exposure on the immune system have been studied in rhesus monkeys and other animals. Study results indicated a significant decrease in the size of the thymus gland (which is critical to the immune system), reductions in the response of the immune system following a challenge, and decreased resistance to the Epstein-Barr virus and other infections.


For the human reproductive system, women exposed to PCBs before or during pregnancy can give birth to children with significant neurological and motor control problems including lowered IQ and poor short-term memory.

Studies in humans who have been exposed to PCBs have suggested impacts on the nervous system such as persistent and significant deficits in neurological development that include visual recognition, short-term memory, and learning.

Lastly, for the endocrine system, PCBs have been demonstrated to exert effects on thyroid hormone levels in both animals and humans. Thyroid hormone levels are critical for normal growth and development, and alterations in thyroid hormone levels may have significant implications.

From an environmental perspective, and ultimately a human health perspective as well, PCBs do not readily break down; therefore, they may remain for long periods of time cycling between air, water, and soil. Because they are lightweight, PCBs can be carried long distances and have been found in snow and sea water in areas far away from where they were released into the environment. While wandering the earth, PCBs are known to accumulate in the in the leaves and above-ground parts of plants and food crops.

PCBs are also taken up into the bodies of small organisms and fish. Their buildup in fish can reach levels that are hundreds of thousands of times higher than their levels in water. Currently, fish consumption advisories are in effect for PCBs in all five of the Great Lakes. According to the EPA, PCBs (not mercury) are the leading chemical risk to humans from fish consumption.



Health Issues

- **PCB blood levels in teachers**
 - Germany: 151 teachers from 5 different schools.
 - Study found moderate elevations of blood levels of PCB-28 and PCB-101 among teachers in some schools.
- **PCBs in wood floor finish**
 - Cape Cod, MA: Detected PCBs in indoor air in 31% of 120 homes.
 - Study found elevated blood PCB concentrations in residents of homes.

Abrasion-Resistant Floor Finish


<i>Solids</i>	
"Parlon" S20	50
"Aroclor" 1254	25
"Duraplex" C-55	25
<i>Solvents</i>	
"Solvesso" 100	80
Xylene	10

The Chemical Formulary – VOL XV, 1970

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The above studies are examples of the ongoing research concerning the impacts of PCBs.

6.5 Regulation



How is it Regulated?

- Federal environmental laws/statutes:
 - *Toxic Substances Control Act (TSCA)*
- EPA regulations:
 - 40 CFR 761: *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions*
- EPA interpretive guidance:

<http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/guidance.htm>


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The TSCA became law on 11 October 1976. The Act authorized EPA to secure information on all new and existing chemical substances, as well as to control any of the substances that were determined to cause unreasonable risk to public health or the environment. It was because of TSCA that EPA was able to ban the manufacture of PCBs in the United States in 1978.

The implementing regulation, 40 CFR 761, went into effect 1 July 2007. It has been amended multiple times and continues to be amended. Between

numerous amendments and continuing to discover that PCBs were used in more products than initially addressed by the regulations, EPA has issued interpretive guidance to resolve confusion. There is interpretive guidance via a forum where people ask questions on sampling, spill cleanup, how to deal with fluorescent light ballasts containing PCBs, and other issues. Then regulators respond to the questions.⁹

One on of the most recent interpretations that directly impacts the demolition and renovation of buildings was issued on 24 October 2012, titled “PCB Bulk Product Waste Reinterpretation.”¹⁰



How is it Regulated?

- Safety laws/statutes:
 - Occupational Safety and Health Act
- Safety regulations:
 - 29 CFR 1910.1000, Table Z-1 established a PEL of 1 milligram of PCB per cubic meter of air averaged over an 8-hour workshift.
 - 29 CFR 1926.55 adopts the same standard in relationship to construction.
- Safety guidance:
 - www.osha.gov

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The Occupational Safety and Health Act was passed in 1970. While the actual number of OSHA regulations using the term “PCB” is very limited, all of the general requirements concerning respirator use, skin protection, and eye protection are applicable because of the toxicity of PCBs.

Like the EPA, OSHA received a number of letters over the years requesting interpretations on specific safety issues related to PCBs. Those letters and OSHA’s responses can be found at the OSHA website¹¹ by simply searching on the term “PCB.”

⁹ <http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/guidance.htm>

¹⁰ <http://www3.epa.gov/epawaste/hazard/tsd/pcbs/pubs/caulk/reinterpret.htm>

¹¹ <https://www.osha.gov/>



How is it Regulated?

- When do EPA regulations apply?
 - Whenever an item/article containing PCBs is maintained or serviced.
 - Whenever an item/article containing PCBs is removed from service and stored.
 - Whenever an item/article contaminated with PCBs is sent for disposal.
- When do OSHA regulations apply?
 - Whenever there is a potential for exposure.


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Note that all of these regulations have associated documentation, reporting, notification, and operational requirements. Again, more stringent state regulations are seen when there is an expansion of the PCB testing/sampling, work practice, and abatement requirements to nonresidential buildings.

6.6 Demolition and repurposing concerns



Demolition and Repurposing Concerns


- **Transformers** are devices that increase or decrease the voltage level of an electrical current.
 - Filled with dielectric fluid, *PCB-based oil mixtures*
 - Manufactured between 1929 and 1977
- Trade names for PCBs in transformers:
 - Abestol, **Aroclor**, **Askarel**, Chlophen
 - Chlorextol, DK, EEC-18, Fenclor
 - **Inerteen**, Kennechlor, No-Flamol, Phenoclor
 - Pyralene, Pyranol, Saf-T-Kuhl, Solvol
 - Non-Flammable Liquid

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As stated previously, probably the item most commonly thought of when the term “PCBs” is used is transformers. Obviously, since PCB-containing transformers were manufactured and installed from 1929–1977, there are quite a few of them out there.




Demolition and Repurposing Concerns

- **PCB transformer**
 - PCBs at concentrations ≥ 500 ppm
 - Requirements for management:
 - PCB Transformers must be registered
 - Visual inspections
 - Proper PCB identification labels
 - Records of inspections and maintenance
 - May be disposed of in:
 - TSCA chemical waste landfill

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One of the first steps is to determine if any transformers which are going to be disturbed exceed the 500 ppm threshold. Hopefully, the installation has already performed a PCB inventory and knows the answer to that question. If not, testing may be required unless the installation wants to make an assumption that the PCBs exceed 500 ppm, based on the age and manufacturer of the transformer.




Demolition and Repurposing Concerns


- **Caulk** is a flexible material used to seal gaps so that windows, door frames, masonry, and joints in buildings and other structures are watertight or airtight.
 - Also used in window glazing and expansion joints.
 - PCBs imparted flexibility.
 - Used in many buildings, including schools, in the 1950s through the 1970s.
 - September 2009, EPA provided new guidance to communities.

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PCB use in caulk has been a more recently identified issue of concern. The use of PCBs in caulk, window glazing, and expansions joints is so prevalent that the EPA had to issue guidance separate from the existing regulations on how PCB in caulk is to be handled.

**Demolition and Repurposing Concerns**

- Exposure may occur by:
 - Vapor release into the air
 - Dust adsorbs the PCBs and is deposited on surrounding surfaces and soil
 - Direct human contact
- The link between the concentrations of PCBs in caulk and PCBs in the air or dust is not well understood.




<http://www.epa.gov/pcbsincaulk/caulkexposure.htm>

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The particular concerns for PCBs in caulk relate to the PCBs vaporizing and then releasing into the air. This release can result in direct contact with the PCBs.

**Demolition and Repurposing Concerns**


- **New York City Schools**
 - Agreement with EPA to address PCBs in caulk.
 - The city will conduct a study in five schools.
 - Assess and reduce potential exposure by:
 - Cleaning schools
 - Improving ventilation
 - Addressing deteriorating caulk
 - City will ensure any PCB waste is removed.
 - After finalizing the study a plan will be developed and implemented - *identify, prioritize, and address*.

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The issue of PCBs in caulk has become widespread enough that schools (in particular) are being required to address the issue.



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Demolition and Repurposing Concerns

- PCBs were used in paints:
 - to enhance structural integrity,
 - to reduce flammability, and
 - to increase antifungal properties.
- PCBs imparted heat resistance to the paints
- EPA reports that PCB concentrations in dried paint range from 1 ppm to 97,000 ppm.




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When used in paint, PCBs enhanced the paint's properties to make its use particularly attractive in industrial areas on parts such as pipes and in HVAC systems. But PCB use in paint was not restricted solely to industrial areas; it has also been found in areas such as conference rooms and schools.

As the above slide illustrates, the amount of PCBs in paint varies widely. When a survey of PCBs in paint on Army buildings was conducted, the same wide concentration range was found as well.



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Demolition and Repurposing Concerns

172 THE CHEMICAL FORMULARY

Swimming Pool Paint			
	For Concrete		For Steel
Formula No. 1	No. 2 ^a	No. 3 ^b	
<i>Laquer Phase:</i>			
"Parlon" (20-ep)	100.0	100.0	100.0
"Duraplex" C-49 (100%) ^c	50.0	50.0	50.0
"Aroclor" 1254	50.0	50.0	50.0
Titanium Dioxide (Rutile)	112.0	112.0	50.5
Magnesium Silicate	115.0	116.0	50.7
Phthalocyanine Green	2.9	3.0	1.3
"Bentone" 34	13.0	12.0	5.0
"Tween" 60	—	8.5	—
Epichlorohydrin	1.0	—	0.6
Xylene	450.0	210.0	285.0
"Solvesso" 100	90.0	50.7	28.0

Masonry Paints

	For Bricks, Shingles, and Similar Surfaces		For Porous Masonry	
	No. 1	No. 2	No. 3	No. 4
"Parlon" S10	8.00	11.50	5.30	—
"Parlon" S20	4.00	—	—	8.60
"Cloradex" 40	4.00	4.35	1.85	—
"Aroclor" 1254	—	—	—	—
"Duraplex" D-658	—	—	—	—
(85%)	—	7.11	3.27	—
Raw linseed oil	—	—	—	6.40
Linseed oil, heat-bodied, viscosity Z3	—	—	—	6.40
Titanium dioxide	15.20	10.30	20.60	11.40
Zinc oxide	—	3.90	4.10	4.30
"Asbestine" 3X	15.20	6.40	10.40	7.20
Mica (325 mesh white waterground)	—	5.10	6.30	5.80
"Bentone" 34	1.60	—	2.50	2.90
"Amaco Solv" D	—	33.74	31.46	31.16
"Solvesso" 100	—	13.40	10.60	12.00
Turpentine	—	3.54	3.20	3.30
Xylene	51.96	—	—	—
Epichlorohydrin	0.04	0.06	0.03	0.04
"ERL" 2774	—	0.60	—	0.40
Cobalt naphthenate, 6%	—	—	0.03	0.10
"Dyphos"	—	—	0.26	—

PCBs in Paint

The Chemical Formulary – VOL XV, 1970

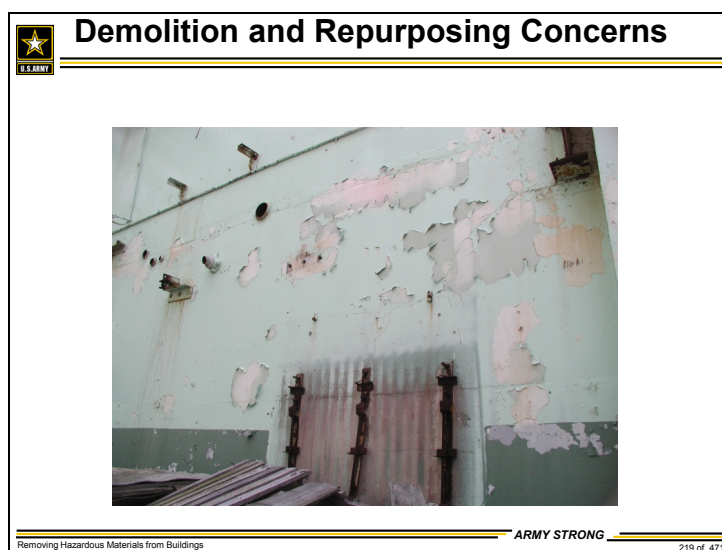
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These material "recipes" come from a 1970 reference book on the chemical industry, *The Chemical Formulary – VOL XV*.

The unit used in the above slide is simply volumetric “parts.” The recipe on the left shows that PCBs, specifically Aroclor 1254, were being used in swimming pool paint as of 1970. The recipe on the right shows the same use in masonry paints. In general, Aroclor 1254 is the PCB most commonly used for paints.



The above photo shows a typical application of wall paints at an industrial site, which are likely to contain PCBs.


6.7 Detection

The slide is titled "Detection" and features a U.S. Army logo. It contains a list of bullet points and a photograph of a DEXIL Clor-N-Soil 50 ppm kit. The kit includes a box, a test tube, and a pipette. The slide footer includes the text "Removing Hazardous Materials from Buildings", "ARMY STRONG", and "221 of 471".

- Simple PCB field screening technologies are available.
- DEXIL Clor-N-Soil 50 ppm
 - Fixed endpoint of 50 ppm
 - Simple, colorimetric
 - For yes/no screening

While there is no requirement for screening old buildings for PCBs, there are a number of different field test kits (based on different technologies) that can quickly screen for PCBs by using a variety of media.

6.8 Management and disposal



Management and Disposal

- No Federal requirement to test, identify, or remove these semi-solid materials.
 - Potential local requirements (e.g., test in schools)
- There are established indoor air quality thresholds.
- If PCBs are detected, there are reasonable steps to minimize exposure, short of wholesale remediation.

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In response to concern over PCBs in schools, EPA has determined a reasonably safe threshold for airborne PCBs. For adults, the figure is 450 ng/m³.¹²

¹² <http://www.epa.gov/pcbsincaulk/maxconcentrations.htm>


6.8.1 Guidance



Links

- [US Army Public Works Technical Bulletin \(PWTB\)](http://www.wbdg.org/ccb/ARMYCOE/PWTB/pwtb_200_1_126.pdf)
http://www.wbdg.org/ccb/ARMYCOE/PWTB/pwtb_200_1_126.pdf
- [US EPA guidance](http://www.epa.gov/pcbsincaulk/caulkresearch.htm)
 - <http://www.epa.gov/pcbsincaulk/caulkresearch.htm>
 - <http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/caulk/index.htm>
 - <http://www.epa.gov/epawaste/hazard/tsd/pcbs/index.htm>
- [Regional PCB Coordinators --](http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/coordin.htm)
<http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/coordin.htm>
- Contractor guide -
<http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/caulk/pdf/contractrs.pdf>

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Management and Disposal

- If you are disposing of equipment or debris with the potential to contain PCBs, there are specific steps that must be taken according to Federal regulations.
- As related to demolition and repurposing, the most common PCB-related wastes are:
 - PCB bulk product waste
 - Other PCBs and PCB items with concentration of PCBs > 50 ppm

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Over the years, personnel with any encounters with PCBs should have the 50 ppm figure firmly planted in their brains. BUT, there are two other issues at play, as outlined below:

1. There are states (very few) that regulate PCBs at a lower concentration. The most notable is California, which has a trigger concentration of 5 ppm for some items.
2. The PCB concentration is not always known.



Management and Disposal

- You do not have to precisely know the PCB concentration of the equipment or debris.
 - EPA has defined a series of scenarios when you can make assumptions about the PCB concentration.

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To address the issue of unknown PCB concentration, the EPA has provided a list of assumptions that can be applied that are based on the type of equipment, size of equipment, and age of the equipment (40 CFR 761.1(b)(2), 761.1(b)(3), and 761.2(a)). Below is a listing of those EPA assumptions:

- Transformers with < 3 lb (1.36 kg) of fluid, circuit breakers, reclosers, oil-filled cable, and rectifiers whose PCB concentration is not established contain PCBs at < 50 ppm.
- Mineral oil-filled electrical equipment that was manufactured before 2 July 1979, and whose PCB concentration is not established, is PCB-Contaminated Electrical Equipment (i.e., contains \geq 50 PCB, but < 500 ppm PCB).
- All pole-top and pad-mounted distribution transformers manufactured before 2 July 1979 are assumed to be mineral-oil filled.
- Electrical equipment manufactured after 2 July 1979 is non-PCB (i.e., < 50 ppm PCBs). If the date of manufacture of mineral oil-filled electrical equipment is unknown, assume it to be PCB-Contaminated.
- Transformers manufactured prior to 2 July 1979, that contain 1.36 kg (3 lb) or more of fluid other than mineral oil, and whose PCB concentration is not established, are PCB Transformers (i.e., \geq 500 ppm). If the date of manufacture and the type of dielectric fluid are unknown, assume the transformer to be a PCB Transformer.
- A capacitor manufactured prior to 2 July 1979, whose PCB concentration is not established contains \geq 500 ppm PCBs.


- A capacitor manufactured after 2 July 1979 is non-PCB (i.e., < 50 ppm PCBs). If the date of manufacture is unknown, assume the capacitor contains ≥ 500 ppm PCBs.
- A capacitor marked at the time of manufacture with the statement “No PCBs” in accordance with 40 CFR 761.40(g) is non-PCB.
- Provisions that apply to PCBs at concentrations of < 50 ppm also apply to contaminated surfaces at PCB concentrations of ≤ 10 micrograms/100 cm².
- Provisions that apply to PCBs at concentrations of ≥ 50 to < 500 ppm apply also to contaminated surfaces at PCB concentrations of > 10 micrograms/100 cm² to < 100 micrograms/100 cm².
- Provisions that apply to PCBs at concentrations of ≥ 500 ppm apply also to contaminated surfaces at PCB concentrations of ≥ 100 micrograms/100 cm².

Unless otherwise noted, PCB concentrations shall be determined on a weight-per-weight basis, or for liquids on a weight-per-volume basis if the density of the liquid is also reported. Unless otherwise noted, PCBs are quantified based on the formulation of PCBs present in the material analyzed.

6.8.2 Bulk product waste

 Management and Disposal	
<ul style="list-style-type: none">• PCB Bulk Product Waste<ul style="list-style-type: none">– Waste derived from manufactured products containing PCBs in a nonliquid state, at any concentration where the concentration at the time of designation for disposal was ≥ 50 ppm PCBs. PCB bulk product waste does not include PCBs or PCB items regulated for disposal under 40 CFR 761.60(a) through 761.60(c), 761.61, 761.63, or 761.64. (40 CFR 761.3)	
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PCB bulk product waste is likely the most common form of PCB-contaminated debris to be encountered in the demolition or renovation process.



Management and Disposal

- PCB bulk product waste includes, but is not limited to:
 - nonliquid bulk wastes or debris from the demolition of buildings and other man-made structures that were manufactured, coated, or serviced with PCBs;
 - PCB-containing wastes from the shredding of automobiles, household appliances, or industrial appliances; and
 - fluorescent light ballasts containing PCBs in the potting material.

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The types of PCB bulk product waste that are most likely to occur in repurposing or demolition are those highlighted in red in the above graphic.

PCBs in caulk has become such a hot issue, particularly in schools, that EPA has published guidance specific to the handling of this waste and now includes it in the definition of PCB bulk product waste.

According to the EPA, if a building was built or renovated between 1950 and 1980, it is more likely to have PCB-containing caulk.



Management and Disposal

- The EPA memorandum, *PCB Bulk Waste Reinterpretation* (dated 24 October 2012) also includes the following as PCB bulk product waste:
 - “allows building material ‘coated or serviced’ with PCB bulk product waste [e.g., caulk, paint, mastics, sealants] at the time of designation for disposal as a PCB bulk product waste.”


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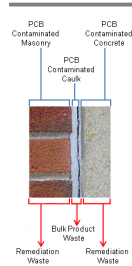
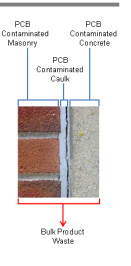
The realization that there are PCBs in caulk, paint, mastics, and sealants and not just in electrical equipment, together with the questions that the EPA was receiving about how to get rid of the additional PCB waste is the

primary reason that EPA issued the 2012 memorandum outlined in the above slide.



Management and Disposal

- PCB bulk product waste:
 - Solid products
 - May dispose in a regular solid waste landfill
- PCB remediation waste:
 - Resulting from a spill or product contamination
- EPA may change rule to allow all of building assembly as bulk product waste.

Current Interpretation	Proposed Reinterpretation
	


<http://www.epa.gov/wastes/hazard/tsd/pcbs/pubs/caulk/reinterpret.htm>

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After much controversy and petitioning of the EPA for decisions, the EPA issued a memorandum in 2012 giving a reinterpretation of what it calls “PCB bulk product waste.” An example of this “before and after” reinterpretation is shown in the above slide, taken from the EPA website.¹³



Management and Disposal

- PCB bulk product waste storage: (40 CFR 761.65)
 - Cannot be stored at the site of generation for more than 180 days.
 - Waste must be placed in a pile designed and operated to control dispersal of the waste by wind, where necessary, by means other than wetting.
 - The waste must not generate leachate through decomposition or other reactions.
 - There must be an appropriate liner.

(continued on next slide)

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A percentage of the waste generated during renovation or demolition will fall under the definition of PCB bulk product waste. If the waste falls into

¹³ <http://www.epa.gov/wastes/hazard/tsd/pcbs/pubs/caulk/reinterpret.htm>

this category, there are storage requirements which have to be met while waiting for the waste to be shipped offsite for disposal.

Unlike asbestos-containing waste, there is a storage time limit of 180 days for PCB bulk product waste. The waste must be under control, and it must sit on a lined surface to prevent any spills or leaks from reaching the environment or from further contaminating other materials.



Management and Disposal

- PCB bulk product waste storage (cont'd):
 - There must be a cover that covers all of the stored waste likely to be contacted by precipitation.
 - The cover must be secured so as not to be functionally disabled by winds expected under normal seasonal meteorological conditions at the storage site.


(continued on next slide)

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The issue of a cover on the stored waste is a sticking point with some regulators. If the storage site is an open-sided, stationary structure such as a pole barn, the PCB bulk product waste must be under enough cover to prevent contact with precipitation. That means the PCB bulk product waste cannot be on the very edge of the covered area.

When using something like a tarp for “cover,” it is not uncommon for personnel removing PCB bulk product waste from a structure to want to leave the cover off the stored waste while they are working. After all it’s not raining at that moment, and they are going to cover it at the end of the day when they are done.

Regulators may interpret this “cover” issue the same as they do for hazardous waste. The only time that is allowed for not having a cover in place is when waste is actually being added to the container. So, when using a tarp or other removable cover, keep the cover on at all times unless more PCB bulk product waste is being added to the pile.




Management and Disposal

- PCB bulk product waste storage (cont'd):
 - There must be run-on control system designed, constructed, operated, and maintained such that:
 - it prevents flow onto the stored waste during peak discharge from at least a 25-year storm, and
 - it collects and controls at least the water volume resulting from a 24-hour, 25-year storm.

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What constitutes a run-on control system? The most common answer is to put the PCB bulk product waste in some form of secondary containment.




Management and Disposal

- What if what you have does not meet the definition of PCB bulk product waste?

Ask the question:
Is the PCB concentration > 50 ppm?
If yes, stay tuned...


If no, check with your State.

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Management and Disposal


- PCB transformers
 - must go to a permitted/licensed chemical waste landfill.



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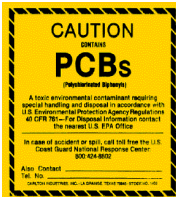


Management and Disposal

- PCBs and PCB items at concentrations of 50 ppm or more that are to be stored before disposal: (40 CFR 761.65)
 - Must be disposed of within 1 year from the date it was declared waste.
 - Must be stored in a structure that meets specific requirements.

OR

- Must meet another set of requirements.



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“PCB items” are defined as any article, article container, container, equipment, or anything else that deliberately or unintentionally contains or has as a part of it any PCB or PCBs. So, for the purposes of this discussion, anything with PCBs at a concentration of 50 ppm or more which is *not* PCB bulk product waste has to be stored according to these requirements. This type of waste includes transformers, capacitors, and ballasts.

Another way to look at the date that an item was declared a waste is to think about the date when it was removed from service. The EPA or state—whoever has primacy—can be petitioned for a one-year extension of the date. But before going through that paperwork drill, think hard about why you are letting the waste sit around on site.

How can it be proved that the PCBs or PCB items have not been sitting around for more than a year? Each item needs to be tagged with the date it was taken out of service.




Management and Disposal

- Storage structure requirements for PCBs and PCB items > 50 ppm:
 - Roof excludes precipitation from contact with PCBs or PCB items.
 - Flooring with minimum 6-inch continuous curb and made of Portland cement, concrete, or a continuous, smooth, nonporous surface that prevents or minimizes penetration of the PCBs.

(continued on next slide)

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The required curbing for storage must provide a containment volume equal to at least two times the internal volume of the largest PCB article or PCB container, *or* 25% of the total internal volume of all PCB articles or PCB containers stored there, *whichever is greater*.




Management and Disposal

- Storage structure requirements for PCBs and PCB items > 50 ppm (cont'd):
 - No drains, valves, floor drains, expansion joints, sewer lines, or other openings.
 - Not below a 100-year floodplain elevation.
 - Marked with:

CAUTION
CONTAINS
PCBs
(Polychlorinated Biphenyls)
A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761—For Disposal Information contact the nearest U.S. E.P.A. Office.
In case of accident or spill, call toll free the U.S. Coast Guard National Response Center: 800-424-8802
Also Contact
Tel. No.

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Marking PCB storage is another situation where the EPA is very specific about what the label has to say, how large the typeface is, and how it is displayed. There are labels readily available which are preprinted and typically have a yellow background.




Management and Disposal

- What if I don't have a structure that meets the requirements outlined in the last two slides for storing PCBs or PCB Items with > 50 ppm?
 - That is ok, if.....

Continued on next slide

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PCB items > 50 ppm are not being stored long-term. However, questions arise about if time does not allow for items to be removed from the structure and off the installation on the same day, and there is no location that meets the requirements in the preceding slides. Now what?



Management and Disposal

- One of the following is alternatively required:
 - You are already permitted to manage hazardous waste in containers.
 - You are an interim-status hazardous waste facility.
 - You are approved or otherwise permitted by the state.


AND

Only certain types of PCB items are stored.

Continued on next slide

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Keep in mind that overall, it is easier to store the PCB Items > 50 ppm in structures that meet the design requirements than it is to get the necessary permit. But if you have to get the permit, start that process before you start the renovation or the demolition project.




Management and Disposal

- PCB items acceptable for alternative storage in a temporary 30-day noncompliant storage area:
 - nonleaking PCB articles and PCB equipment
 - leaking PCB articles and PCB equipment placed in a nonleaking PCB container that contains sufficient sorbent material to absorb liquid contained on the PCB article or equipment
 - PCB containers in which nonliquid PCBs have been placed

Continued on next slide

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Management and Disposal

- PCB items acceptable for alternative storage in a temporary 30-day noncompliant storage area (cont.):
 - PCB containers containing liquid PCBs at a concentration ≥ 50 ppm, provided a Spill, Prevention, Control, and Countermeasure (SPCC) plan has been prepared for the temporary storage area and the liquid PCB waste is in DOT-authorized packaging or stationary bulk storage tanks.


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If you do get the necessary approvals and are storing the PCB items in a temporary location, you must make sure they are out the door to wherever they are going *within 30 days*.



Management and Disposal


- ALSO, the following can be stored on pallets next to a compliant storage area if they have been drained of free-flowing dielectric fluid:
 - PCB large, high- voltage capacitors
 - PCB-contaminated electric equipment



The capacitors and electric equipment stored on pallets must also be nonleaking and structurally undamaged and be inspected weekly.

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As the above slide explains, it is also allowable to store PCB-contaminated large, high-voltage capacitors and PCB-contaminated electrical equipment on pallets outside of a compliant storage area if they have been drained of free-flowing dielectric fluid, they are undamaged, and they are inspected weekly.




Management and Disposal

- Operational requirements when storing PCBs or PCB Items > 50 ppm:
 - Inspections done every 30 days.
 - PCB items are marked with the date they were removed from service AND positioned so they can be located by the marked date.

Continued on next slide

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When storing PCBs or PCB items with concentrations > 50 ppm, each piece of equipment must be inspected every 30 days (looking for leak potential and proper markings) regardless of whether the item is in compliant or alternative storage.




Management and Disposal

- Operational requirements when storing PCBs or PCB items > 50 ppm (cont'd):
 - Movable equipment used for handling PCBs and PCB Items that directly contact PCBs is not removed from storage unit unless decontaminated.
 - Leaking PCB Items are transferred to nonleaking containers and spills cleaned up.

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In addition to having to think about managing the PCB items themselves, there needs to be a plan for managing the equipment (e.g., forklifts) used to handle PCBs or PCB items. The equipment must stay in that specific storage area unless it is decontaminated. And obviously, any spill must be quickly addressed.




Management and Disposal

- What must be done with PCBs depends on answers to:
 - What is the object (transformer, ballast, capacitor, etc.)?
 - What is the concentration of PCBs in the object?

PCBs are different from many other hazardous buildings materials because, by regulation, you can do decontamination instead of disposal.

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The option of decontamination versus disposal is a decision that will most likely be made based on costs. Those costs will vary from location to location and from item to item.



Management and Disposal

- PCB-contaminated electrical equipment, except capacitors:
 - Must remove all free-flowing liquid from the equipment, then dispose of according to one of the following:
 - a facility that is permitted, licensed, or registered to manage municipal solid waste or nonmunicipal nonhazardous waste (excluding thermal treatment units),
 - in an approved scrap metal recovery oven or smelter, or
 - in an approved disposal facility.

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If the waste does not fall into the definition of PCB bulk product waste, it may fall into the definition of PCB-contaminated electrical equipment.

PCB-contaminated electrical equipment is any electrical equipment including, but not limited to, transformers (including those used in railway locomotives and self-propelled cars), capacitors, circuit breakers, reclosers, voltage regulators, switches (including sectionalizers and motor starters), electromagnets, and cable, that contains PCBs at concentrations of ≥ 50 ppm and < 500 ppm in the contaminating fluid. In the absence of liquids, electrical equipment is PCB-Contaminated if it has PCBs at $> 10 \mu\text{g}/100 \text{ cm}^2$ and $< 100 \mu\text{g}/100 \text{ cm}^2$ as measured by a standard wipe test (as defined in 40 CFR 761.123) of a nonporous surface (40 CFR 761.3)

If it meets the definition of PCB-contaminated electrical equipment, then the free-flowing liquid must be removed prior to disposal. After the liquid is removed, there are options for disposal.




Management and Disposal

- Capacitors:
 - PCB small capacitors (less than 1.36 kg [3 lb] of PCBs) may be disposed of in a solid waste landfill
 - PCB large, high- or low-voltage capacitors (greater than 1.36 kg [3 lb] of PCBs) containing more than 500 ppm must be incinerated in a approved incinerator.
 - Large capacitors that contain ≥ 50 ppm but < 500 ppm must be disposed of in an approved disposal facility.

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While capacitors are included in the definition of “PCB-contaminated electrical equipment,” there are also more-specific disposal requirements, depending on the size of the capacitor and the concentration of PCBs.

As defined in 40 CFR 761.3, a *PCB capacitor* is any capacitor that contains ≥ 500 ppm PCB. Concentration assumptions applicable to capacitors appear under 40 CFR 761.2.



Management and Disposal


- PCB Transformers – if concentration > 500 ppm, must be incinerated or disposed of in a chemical waste landfill.



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Again, a PCB transformer is a type of PCB-contaminated electrical equipment, but there are more specific requirements for disposal of transformers, depending on the concentration of PCBs.

A PCB transformer is any transformer that contains ≥ 500 ppm PCBs. For PCB concentration, assumptions applicable to transformers containing 1.36 kg (3 lb) or more of fluid other than mineral oil, see 40 CFR 761.2. For provisions permitting reclassification of electrical equipment, including PCB transformers containing ≥ 500 ppm PCBs to PCB-contaminated electrical equipment, see 40 CFR 761.3(a) and 40 CFR 761.3(h).




Management and Disposal

- Ballasts
 - Fluorescent light ballasts containing PCBs in an **intact** and **non-leaking** PCB small capacitor
 - These can go to the municipal solid waste landfill if it will take them.
 - Fluorescent light ballasts containing PCBs in the potting material:
 - Dispose of as bulk product waste.

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As you can see from the slide above, how PCB-containing ballasts are sent for disposal depends entirely on the type of ballasts they are.




Management and Disposal

- PCB disposal recordkeeping:
 - For any disposal of PCB bulk product waste, a written record must be maintained of all sampling and analysis of PCBs or notifications made for 3 years from the date of the waste's generation.
 - Certificate(s) of Disposal
 - Any associated Exception Reports

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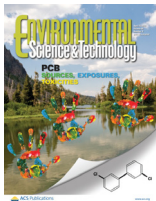


As with any kind of waste that potentially contains a contaminant, documentation of what it was, where it went, and what happened to it is critical.

6.9 Future of PCBs



What's Next?

- EPA is proposing changes to PCB regulations to specifically address issues like PCBs in caulk.
- ES&T journal issue dedicated to PCBs:
 - April 15 2010
 - Volume 44, Issue 8, pages 2747-3200



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7 Heavy Metals

7.1 Terminology




Terminology

- OSHA uses the term “Toxic Metals” to encompass the following:

- | | |
|------------------------------|-------------------|
| • Arsenic | • Aluminum |
| • Beryllium | • Antimony |
| • Cadmium | • Cobalt |
| • Hexavalent chromium | • Copper |
| • Lead | • Iron |
| • Mercury | • Manganese |
| | • Molybdenum |
| | • Nickel |
| | • Selenium |
| | • Silver |
| | • Tin |
| | • Vanadium |
| | • Zinc |

The first column in the above slide are those metals which are most commonly thought of when the term “heavy metals” or “toxic metals” is used. The second column is a list of additional metals which are also considered toxic metals by OSHA but are perhaps not as concerning, depending on the route of exposure. All of these heavy metals, and the exposure to each, are regulated by OSHA.

The use of arsenic will be addressed in Chapter 9, which discusses treated wood. Materials which are **in bold** in the above slide are the ones addressed in this training. (Although not highlighted here, beryllium may be found in the form of beryllium-copper alloys in electrical components.)



Terminology

- EPA looks at heavy metals in terms of:
 - Cleaning up those which have already contaminated the soil
 - Preventing further soil or water contamination
 - Contaminants in drinking water sources
 - Emissions discharged to the air

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While OSHA is concerned about heavy or toxic metals from the point of harmful exposure to workers, EPA is concerned about those metals as a potential environmental contaminant, when found in excess.

Per the EPA, “heavy metals” are metallic elements with high atomic weights (e.g., mercury, chromium, cadmium, arsenic, and lead) that can damage living things at low concentrations and tend to accumulate in the food chain.

Again, the EPA regulates releases to the environment and exposure to the general public, as opposed to OSHA, which specifically covers workers’ exposure.



Terminology

EPA heavy metals and brownfields cleanup:

<ul style="list-style-type: none"> • Aluminum • Antimony • Arsenic • Barium • Beryllium • Cadmium • Calcium 	<ul style="list-style-type: none"> • Chromium (total) • Chromium (hexavalent) • Cobalt • Copper • Iron • Lead • Manganese • Magnesium 	<ul style="list-style-type: none"> • Mercury • Nickel • Potassium • Selenium • Silver • Sodium • Thallium • Vanadium • Zinc
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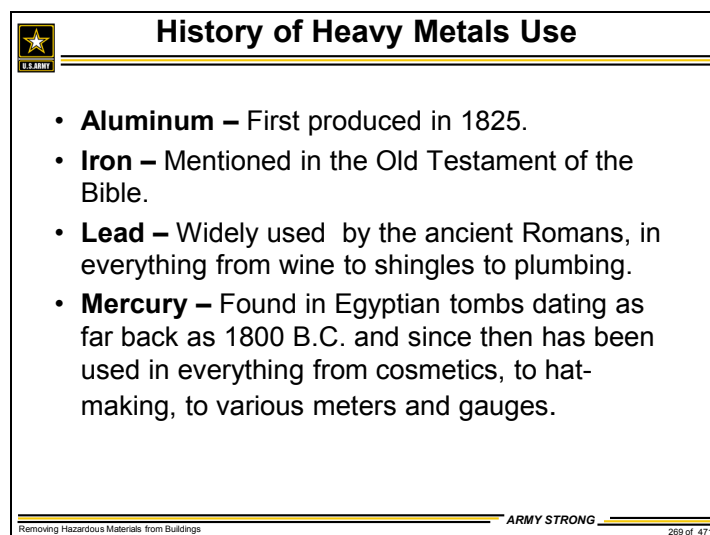
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There is some crossover between the OSHA “toxic metals” list and the above EPA list, which is specific to EPA’s standards for cleaning up a previously used industrial or commercial area with real or perceived environmental contamination (i.e., brownfield) prior to its reuse. But there are also items on each list that do not appear on the other’s list, due to the differing mission of each agency.

A subset of these metals are also regulated as hazardous waste if they fail the toxicity characteristic leaching procedure (TCLP), a common lab test.

7.2 History of use




History of Heavy Metals Use

- **Aluminum** – First produced in 1825.
- **Iron** – Mentioned in the Old Testament of the Bible.
- **Lead** – Widely used by the ancient Romans, in everything from wine to shingles to plumbing.
- **Mercury** – Found in Egyptian tombs dating as far back as 1800 B.C. and since then has been used in everything from cosmetics, to hat-making, to various meters and gauges.

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The use of heavy metals is well documented throughout history, as shown in the above graphic. Even the names of some periods of history are based on metals (e.g., the Iron Age).



History of Heavy Metals Use

- **Copper** – Considered to be man’s oldest metal, dating back more than 10,000 years. Throughout the ages it has been used in jewelry, weaponry, medication, and more recently piping and wiring.
- **Chromium** – First isolated from its mineral form in 1797 when it was primarily used in paints. Now, it is mostly used in plating alloys.
- **Zinc** – Discovered in 1746, though it already had been used in brass for many years.


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As shown by the two slides shown here, heavy metals have been used in everything from weapons, to jewelry, to household goods.

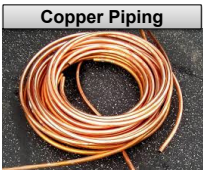
7.3 Use by U.S. Army




Heavy Metals in Building Materials




Stainless Steel



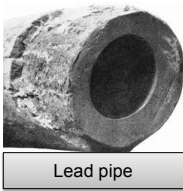
Copper Piping



Mercury-containing
Thermostat



Galvanized steel



Lead pipe

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Today, *mercury* is found in such building parts as thermometers, barometers, switches, thermostats, flow meters, lamps, paints, stains, batteries, and fluorescent lamps.

Copper is found in ductwork, electrical wiring, and plumbing.


Lead may be found in piping or solder. We will address lead-based paint in another module of this training as it has its own issues and concerns.

Chromium is used to make stainless steel “stainless.”

Zinc is used to coat other metals (galvanize) to prevent the metals from rusting, in alloys such as brass, bronze, and nickel; and in solder.

Thus, there are heavy metals in use throughout both past and current construction.

7.4 Health issues



Health Concerns

- Inhalation
 - Inhalation concerns when the component made of (or containing) heavy metals is subject to grinding, cutting, or otherwise creating dust/fine particles.
 - In the case of mercury, if the mercury is not enclosed in a sealed container, you are exposed to mercury vapors.

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Health effects include irritation of the lining of the nose, runny nose, and breathing problems (e.g., asthma, cough, shortness of breath, wheezing).

Specifically, inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. The long-term effects of breathing high levels of zinc are not known.

But, we do know from studies dealing with LBP that lead-containing dusts can lead to neurological problems.

The nervous system is very sensitive to all forms of mercury. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Short-term exposure to high levels of metallic mercury vapors may cause health effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart

rate, skin rashes, and eye irritation. (It was widespread exposure to mercury in the hat-making industry that led to the phrase “mad as a hatter” and the character known as the Mad Hatter in *Alice in Wonderland*.)




Health Concerns

- Ingestion
 - Ingesting high levels of heavy metals can cause nausea, vomiting, and diarrhea.
 - Very high doses can cause damage to your liver and kidneys, and can even cause death.
- Dermal exposure
 - When your skin comes into contact with chromium, small amounts of chromium will enter your body.

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It has been proven that putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice will cause skin irritation. It is assumed that similar skin irritation would probably occur in people as well.



Health Concerns

- Carcinogenic?

<ul style="list-style-type: none"> – Aluminum: <ul style="list-style-type: none"> • Dept Health and Human Services (DHHS): No • EPA: Possibly – Chromium: Yes – Copper: No – Iron: No 	<ul style="list-style-type: none"> – Lead: <ul style="list-style-type: none"> • DHHS: No • EPA: Probably – Mercury: Possibly – Zinc: <ul style="list-style-type: none"> • DHHS: No • EPA: Unsure
--	---

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Annually, the U.S. Department of Health and Human Services (DHHS) National Toxicology Programs released the Report on Carcinogens


(RoC).¹⁴ This report is congressionally mandated and identifies agents, substances, mixtures, and exposure circumstances that are known or reasonably anticipated to cause cancer in humans.

The EPA, on the other hand, mostly gets involved in evaluating cancer-causing potentials in the pesticide registration process and when evaluating the production of new chemicals.

It should be noted that the two agencies do not always agree. Sometimes the disagreement has to do with differences in the testing methodologies they are using and/or a difference in how data is interpreted.

The real oddball at the moment is zinc. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable due to its human carcinogenicity.¹⁵ But basically, EPA officials currently are not sure one way or the other.

7.5 Regulation



EPA and Heavy Metals

- Heavy metals in drinking water:

Antimony	Copper
Arsenic	Lead
Barium	Mercury
Beryllium	Selenium
Cadmium	Thallium
Chromium (total)	

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¹⁴ National Toxicology program: US Department of Health and Human Services:
<http://ntp.niehs.nih.gov/?objectid=03C9AF75-E1BF-FF40-DBA9EC0928DF8B15>

¹⁵ EPA information from the Integrated Risk Information System (IRIS).

The above list contains the heavy metals that the EPA regulates in drinking water. This reference to drinking water means only the water that is provided by a public drinking water system and not the drinking water that might be pulled out of a backyard well.



EPA and Heavy Metals

- Heavy metals in the air
 - The EPA regulates the emission of 187 “Hazardous Air Pollutants” plus emissions of lead.
 - The list includes, but is not limited to: cadmium, mercury, chromium, and lead compounds

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Air emission regulations for these heavy metals are issued in terms of the types of emission sources. For example, regulations for emissions from incinerators prohibit the general emission of these materials unless very specific emission control-and-capture devices are in place.



OSHA and Heavy Metals

- OSHA regulates exposure to a long list of heavy metals at:
<https://www.osha.gov/SLTC/metalsheavy/>

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As with other hazardous materials, the OSHA exposure requirements are based on how long a worker can safely be exposed to a heavy metal, which

depends on the form of that metal (i.e., whether it is in a dust, liquid, or solid form).

7.6 Demolition and repurposing concerns



Demolition and Repurposing Concerns

- Separate the heavy metal components from other components/debris.
- Determine if there is a potential for exposure to heavy metals such as mercury or lead; if yes, consult the base Industrial Hygienist for guidance on safety measures.
 - Concern when cutting/grinding heavy metals with known human health effects such as lead.
 - Ensure that C&D team is briefed on how to handle mercury spills in case of broken, old thermostats.

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The easiest way to get rid of heavy metal-containing components is definitely recycling. Any scrap metal dealer will accept ferrous (iron and steel) and some non-ferrous metals (like copper [Cu] and aluminum [Al]). Lead (Pb) recyclers are less common, but should be available in most metro areas.




7.7 Management and disposal

7.7.1 Management during demolition or repurposing



Managing Heavy Metals During Demolition/Repurposing

- Recycle metal-containing components if at all salvageable:
 - Wiring
 - Rebar
 - Structural steel
 - Plumbing
 - Ductwork
 - Etc.




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Again, the easiest way to get rid of heavy metal-containing components is definitely recycling.

**Managing Heavy Metals During Demolition/Repurposing**


- If sent for disposal and not recycled, the following is a hazardous waste:
 - Lead piping/solder (hazardous waste code D008)
- Except for mercury, any other metal item sent for disposal is likely to be considered construction and demolition (C&D) debris/waste unless otherwise contaminated
- Mercury-containing equipment is considered “Universal Waste”(UW).

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7.7.1 Universal waste

“Universal waste” (UW) is a term coined by the federal EPA to address some specific waste streams that have hazards associated and would otherwise be considered hazardous waste. UW regulations came in to existence in 1995 as an alternative for management and disposal of certain types of problematic items.

Because these individual waste streams have well-established recycling alternatives, if they are recycled and otherwise handled as UW, the installation does not have to count these specific wastes as a part of its monthly total quantities of hazardous waste generation. While this distinction may not make a difference in the hazardous waste generator status for most large installations, it certainly can make a difference at Army Reserve centers or Army National Guard locations.




Universal Waste

- If not handled as UW, items would most likely be considered hazardous waste or some type of special waste.
- Often there is a recycling option for these items and the Universal Waste rules promote that aspect.


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An installation will be classed as either a large-quantity handler or a small-quantity handler of UW. The dividing line between the two designations is the accumulation of 5,000 kg or more total weight of UW (e.g., batteries, pesticides, mercury-containing equipment or lamps), calculated collectively at any time. Installations generating < 5,000 kg would be classed as small handlers.



Universal Waste

- Universal Waste includes:
 - Batteries
 - Mercury-containing equipment
 - Fluorescent lamps
 - Waste pesticides




There are States which include additional items such as e-waste.

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The items in red are those which are most likely to be encountered when conducting renovation and/or demolition, and that also are likely to contain mercury.

Old thermostats and fluorescent lamps are probably the most common of mercury-containing equipment. Mercury-containing batteries may also be found in some smoke alarms or old “exit” signs.



Federal Universal Waste Definitions


- *Lamp* - the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infrared regions of the electromagnetic spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps. (40 CFR 260.10 and 273.9)

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Please note that the above definition of “lamp” is talking about more than just the long skinny fluorescent bulbs, as illustrated below.




Federal Universal Waste




Close-up of a 175W mercury vapor lamp.



High-pressure sodium lamp 600W



Example of a metal halide lighting pole, at a baseball field.




A low-bay light fixture using a high wattage metal halide lamp, of the type used in warehouses.

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The above photos are some examples of other types of bulbs which need to be handled as universal waste.



Federal Universal Waste Definitions

- *Mercury-Containing Equipment* - a device or part of a device (including thermostats, but excluding batteries and lamps) that contains elemental mercury integral to its function. (40 CFR 260.10 and 273.9)

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Under the above definition, consideration should be given to any item that contains mercury, not just thermostats and fluorescent bulbs.

7.7.2 Disposal

7.7.2.1 Predisposal requirements



UW Storage Requirements Prior to Disposal

- May not be accumulated for more than 1 year from the date it was generated.
- Have to be managed in a way that prevents any releases to the environment.
- Employees handling UW must have UW training.

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For the purposes of this curriculum, it will be assumed that Army installations are large-quantity handlers of UW, which means the installation as a whole accumulates 5,000 kg or more total of UW (e.g., batteries, pesticides, mercury-containing equipment, or lamps), calculated collectively at any point in time.

The following are choices of actions to prove that UW has not been sitting around for more than 1 year.

- Put the UW in a container and mark or label the container with the date that any universal waste was put in the container.
- Mark the date on each individual UW item.
- Maintain an inventory system onsite that identifies the date each UW became a waste or was received.
- Place the UW in a specific accumulation area and identify the earliest date that any universal waste in the area became a waste or was received.


These requirements are quite straightforward, and most installations already have a UW program.

**UW Storage Requirements Prior to Disposal**

- If there is evidence of leak potential, put the UW in a container.
- Containers for UW must stay closed except when waste is being actively added.
- Container for UW must be structurally sound, compatible with the contents of the device, and lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions.

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The UW requirements above should appear very familiar to anyone who has worked with hazardous waste; they are basically the same except for the words on the label.




UW Storage Requirements Prior to Disposal

- Lamp-specific storage requirements:
 - Must be stored in containers or packages that are structurally sound, adequate to prevent breakage, and compatible with the contents of the lamps.
 - Must immediately clean up and place in a container any lamp that is broken or any lamp that shows evidence of breakage, leakage, or damage that could cause the release of mercury to the environment.

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Another common misconception about fluorescent lamps is that “green-tip” bulbs do not contain any mercury. This is not the case. Green-tip bulbs contain less mercury than fluorescent lamps that are not green-tip bulbs, but they are not mercury-free. Also, unlike requirements for other types of UW, putting the lamps in proper containers is *not* optional. Containerization must be done, and the container has to meet certain regulatory standards



UW Storage Requirements Prior to Disposal


- Storing UW lamps in a bag is NOT an option!

INCORRECT



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As shown in the above slide, storing UW lamps as casual garbage area is not an option for a military installation, even if it would be an option for private-sector homeowners.




UW Storage Requirements Prior to Disposal

- Lamp-specific storage requirements:
 - Each lamp or a container or package in which lamps are contained must be labeled or marked clearly with one of the following phrases:
 - Universal Waste – Lamp(s)
 - Waste Lamp(s)
 - Used Lamp(s)

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As shown above and below, there are some options for the actual verbiage on the label, unlike the more stringent hazardous waste labeling. It is possible to buy these labels pre-made, make your own labels, or simply stencil the words on the container.




UW Storage Requirements Prior To Disposal

- Mercury-containing equipment, specific storage requirements:
 - Mercury-containing equipment (i.e., each device), or a container in which the equipment is contained, must be labeled or marked clearly with any of the following phrases:
 - Universal Waste – Mercury-Containing Equipment
 - Waste Mercury-Containing Equipment
 - Used Mercury-Containing Equipment

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7.7.2.2 Disposal requirements




UW Disposal

- Mercury-containing thermostat, specific storage requirements:
 - A universal waste mercury-containing thermostat or a container holding only universal waste mercury-containing thermostats must be labeled or marked clearly with any of the following phrases:
 - Universal Waste Mercury Thermostat(s)
 - Waste Mercury Thermostat(s)
 - Used Mercury Thermostat(s)

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Notice that thermostats get their own labeling separate from mercury-containing equipment in general.



UW Disposal


- UW must go to a UW destination facility (often a recycler).
- UW cannot sit at a transfer facility for more than 10 days.
- Transporters on public roads must comply with Department of Transportation (DOT) requirements.
- Every shipment of UW must be accompanied by a bill of lading or manifest documenting the amount of waste and where it is going.

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Like hazardous waste, UW cannot go just anywhere. The installation must have proof that UW is going to a UW destination facility, and documentation is very similar to that required for hazardous waste. It is not uncommon to see a hazardous waste manifest used for UW. If that is done, be sure that the manifest is very clearly marked as UW and not as hazardous waste.

UW Disposal

- But I don't have to handle it as UW at home!!!
- The installation is not a residence, it is an institution – different regulations



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There *are* states or municipalities which are beginning to regulate the disposal of what is otherwise known as universal waste as household hazardous waste. In effect, the municipality is prohibiting their residents from disposing of batteries, lamps, and pesticides in the trash.

Unlike a business or public-sector entity, the resident does not have to use a manifest or bill of lading, but they do have to take their household hazardous waste to designated locations at community centers, community waste drop-off days, or local vendors that accept these materials.

UW Disposal

- A record of each shipment of universal waste shipped offsite must be kept in one of the following:
 - a log,
 - invoices,
 - manifests,
 - bill of lading, or
 - other shipping document.


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Records must be retained for at least 3 years, based on the following:

- For shipments received at the facility, retain records 3 years from the date of receipt of the shipment.
- For shipments sent off-site by the handler, retain records 3 years from the date the shipment left the facility.



UW Disposal


- The off-site shipment record must contain:
 - name and address of the handler, destination facility, or foreign destination to whom the universal waste was sent
 - the quantity of each type of universal waste shipped
 - the date the shipment left the facility.
- Keep records for 3 years from the date the shipment left the site.

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Again, the recordkeeping requirements are very similar to those required for hazardous waste.

8 Crystalline Silica

8.1 Terminology



Silica Terminology


- Silica is a chemical compound (SiO_2).
- Most common form is quartz.
- There are two types of silica:
 - Crystalline
 - Amorphous
- Currently, there are no federal legal definitions.

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8.2 Health issues



Silica Health Concerns


- Silica exposure may cause scarring of the lungs resulting in silicosis.
- Silicosis is not reversible.
- Silicosis may not show up until 20, 30, 40 years after exposure.
- Crystalline silica was declared a probable carcinogen in 1987.

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According to NIOSH, at least 1.7 million U.S. workers are exposed to respirable crystalline silica in a variety of industries and occupations, including construction, sandblasting, and mining. The issue is not the silica in and of itself, but rather the dust particulates which can be inhaled that cause the problem.



Silica Health Concerns

- Healthy lungs vs. lungs with silicosis




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Obviously, the healthy lungs are on the left.



History of Silica Concerns

- 1700 – Dr. Bernardino Ramazzini identified evidence of silicosis in stone cutters.
- Early 1930s – Gauley Bridge tunnel project
- 1938 – first National Silicosis Conference
- 1971 – OSHA sets permissible exposure limit (PEL) of 0.1 mg/m^3 for construction workers.
- 1996 – Secretary of Labor starts the campaign “It’s Not Just Dust.”

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Dr. Bernardino Ramazzini is considered to be the founder of occupational medicine.

The Gauley Bridge tunnel project in West Virginia became the site of one of the worst industrial disasters in U.S. history. Hundreds of workers died from silicosis while building the tunnel and another 1,500 were reported to have contracted the disease within two years of working on the project. This disaster prompted a Congressional call to action.

In 1938, Secretary of Labor Francis Perkins held a National Silicosis Conference and initiated a campaign to “Stop Silicosis.” She stated: “Our job is


one of applying techniques and principles to every known silica dust hazard in American industry. We know the methods of control – let us put them in practice.”

By 1996, the Secretary of Labor began a new campaign to raise awareness and encourage safer work practices called “It’s Not Just Dust,” and initiated a Special Emphasis Program (SEP) on silicosis to provide guidance to “reduce and eliminate the workplace incidence of silicosis from exposure to crystalline silica.” In addition, OSHA, NIOSH, and the American Lung Association held a conference, “The Campaign to End Silicosis.”

Although a regulation has not yet been issued, every U.S. Labor Secretary since 1996—under both Republican and Democratic Administrations—has kept the control of silica dust and protection of workers as a regulatory priority.

In response to growing concerns about silicosis, OSHA set a general limit in 1971 for the maximum amount of airborne dust an employee may be exposed to during a full work shift. The PEL for silica is 0.1 mg/m³ for the construction industry.

8.3 Regulation



How Is It Regulated?

- OSHA set PEL for silica (29 CFR 1926.55)
- EPA was petitioned in 2012 to regulate emissions of silica from fracking.
 - EPA declined, indicating the issue would be reviewed the next time particulate matter ambient air quality standards are reviewed.
- OSHA proposed new standards in 2013:
 - Proposal for new PEL of 50 micrograms of respirable crystalline silica per cubic meter of air (µg/m³).

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As was mentioned in the preceding section, OSHA set the PEL for silica in 1971. Regulation 29 CFR 1926.55 is actually about the exposure of construction workers in general to gases, vapors, fumes, dusts, and mists. It

states that “Exposure of employees to inhalation, ingestion, skin absorption, or contact with any material or substance at a concentration above those specified in the ‘Threshold Limit Values of Airborne Contaminants for 1970’ of the American Conference of Governmental Industrial Hygienists, shall be avoided.”

The regulation further explains that the way exposure is avoided is to first implement administrative or engineering controls. Then if such controls are not feasible to achieve full compliance, protective equipment or other protective measures shall be used to keep the exposure of employees to air contaminants within the PEL.

Furthermore, any equipment and technical measures used to prevent exposure must first be approved for each particular use by a competent industrial hygienist or other technically qualified person.

So, although the PEL is a specific number, how to ensure that limit is met is left open to rather broad possibilities for interpretation.

In 2012, EPA started looking into the silica issue from the standpoint of it being an ambient air pollutant. EPA was forced into this initial evaluation via petition from a number of communities who were beginning to experience the fracking boom. EPA’s response was basically to say they would look at it later.


In 2013, OSHA proposed new standards for workers exposed to silica. This proposal would not address the concerns of those communities which petitioned the EPA, but it is considered by them to be a step down the right road. In the proposed rule, workers’ exposures for respirable crystalline silica would be limited to a new PEL of 50 $\mu\text{g}/\text{m}^3$, averaged over an 8-hour day.¹⁶

Unlike the current PEL, the proposed regulation also includes provisions for measuring how much silica workers are exposed to, limiting workers’ access to areas where silica exposures are high, using effective methods for reducing exposures, providing medical exams to workers with high silica




¹⁶ https://www.osha.gov/silica/factsheets/OSHA_FS-3683_Silica_Overview.pdf

exposures, and training for workers about silica-related hazards and how to limit exposure.

8.4 Demolition and repurposing concerns

**Demolition and Repurposing Concerns**

- Crystalline silica is EVERYWHERE
 - Concrete
 - Dimension stone (e.g., sandstone, granite, limestone)
 - Old sandpaper and grinding wheels
 - Filler in plastics, rubber, and paint




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Unless the stone is actually being cut or broken up in some manner, the dust is likely not an issue. But depending on what repurposing and/or demolition involves, worker exposure is a definite concern.

**Demolition and Repurposing Concerns**

- Exposure to silica occurs whenever the following are used on concrete without protective measures:
 - Jackhammers
 - Cut-off saws
 - Tuck pointing
 - Concrete grinder




All recommendations in this section are from the Centers for Disease Control/NIOSH

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Demolition and Repurposing Concerns

- Prevention/reduction methodologies:
 - Use jackhammers with a water-spray attachment

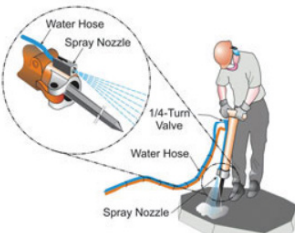



Figure 1. Diagram of water-spray control used in NIOSH study.



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The NIOSH website actually contains instructions on how to do retrofit the jackhammer as shown above, and it seems fairly simple. The key points are the spray angle, spray pattern, and the water flow rate. Experimentation by NIOSH found that the best spray angle was 80 degrees, and the best spray pattern was achieved by using a solid-cone nozzle. Also, they ended up using 350 milliliters (11.8 ounces) of water per minute as the flow rate for dust control.



Demolition and Repurposing Concerns

- Prevention/reduction methodologies (cont'd):
 - Cut-off saws
 - Apply water to the blade through one or two nozzles at a recommended flow rate of 0.5 liters (17 ounces) of water per minute to suppress dust emissions.
 - OR
 - Provide local exhaust ventilation with an exhaust hood (or shroud) that surrounds the blade and is connected to an industrial vacuum cleaner by a flexible hose.


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There are two options for dust control with cut-off saws. The first is to simply apply water to the blade while cutting; however, the flow has to be at an appropriate rate to actually control dust.

The second option is to use a local exhaust ventilation system consisting of a hood that is connected to an industrial vacuum cleaner by a flexible hose. In this option, the vacuum cleaner should have the following features:

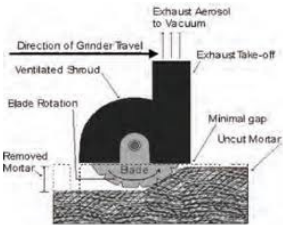

- Sufficient flow rate to capture the dust and transport it to the vacuum source. One study showed that an air flow rate of 70 cfm (cubic feet per minute) was required to achieve effective dust control
- A high-efficiency particulate air (HEPA) filter to reduce the chances of releasing dust containing RCS from the vacuum into the worksite.
- A pre-filter or cyclone to increase the length of service of the HEPA filter.
- A filter replacement indicator, such as a pressure gauge. If the vacuum cleaner does not have a pressure gauge, workers can monitor the air flow by checking to see if a dust plume is escaping from around the shroud.
- The ability to clean and replace filters and full collection bowls or bags without exposing the operators to dust.
- A motor that draws at least 10 amps.

Additionally, the hose needs to be of a 2-in. diameter with a smooth interior and a length of no more than 15 ft to provide adequate air flow for capturing and transporting the dust. The hose should have as few elbows or turns as possible.



Demolition and Repurposing Concerns

- **Prevention/reduction methodologies** (cont'd):
 - Tuck-pointing grinders
 - Use of local exhaust ventilation dust control includes a shroud that encloses most of the grinding wheel, a length of flexible hose, and an industrial vacuum cleaner.




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For tuck-pointing grinders, the vacuum should have a minimum air-flow rate of 65 cfm. The objective is to provide an air flow of 80 cfm to achieve


effective dust control. Be sure to use a vacuum cleaner with a cyclonic pre-separator (cyclone) to keep debris from reaching the final filters. This feature will enable the vacuum cleaner to maintain an adequate airflow, which will facilitate dust capture and transport.

A pressure gauge can be used to monitor the performance of the vacuum cleaner. If the vacuum cleaner does not have a pressure gauge, workers can monitor the air flow by checking to see if a dust plume is escaping from the shroud. If dust is escaping, turn off the unit and clean or change the filter as recommended by the manufacturer. The final filter should be a HEPA-type filter to reduce the chance of releasing dust containing crystalline silica from the vacuum into the worksite.

The shroud should totally enclose the spaces around the exhaust entry point for the hose. The shroud should have an entry point for the hose that matches the diameter of the hose. Some tuck-pointing grinders come with an attached shroud; otherwise it must be purchased separately.

**Demolition and Repurposing Concerns**

- Prevention/reduction methodologies (cont'd):
 - Concrete grinder
 - Local exhaust ventilation systems of a grinder equipped with a ventilation shroud, a length of flexible hose, and a portable electric vacuum cleaner that acts as the fan and dust collector for the ventilation system.



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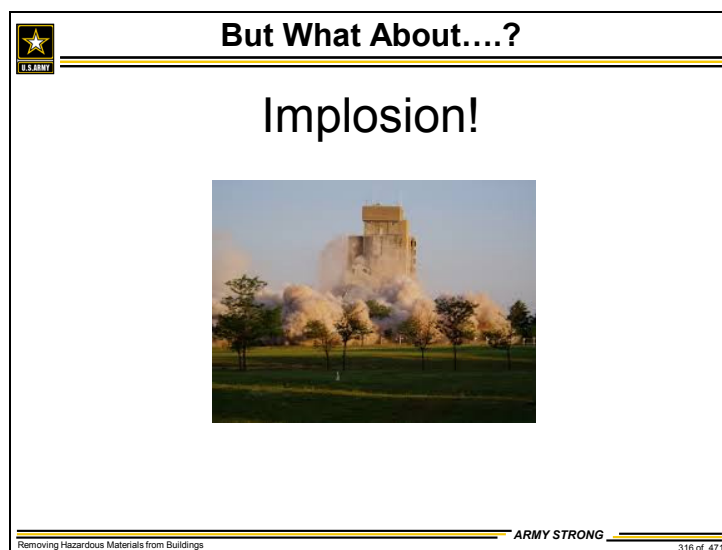
The vacuum for a concrete grinder should have the following features:

- Sufficient flow rate to capture the dust and transport it to the vacuum source.
- A HEPA filter to reduce the chances of releasing dust containing RCS from the vacuum into the worksite.
- A pre-filter or cyclone to increase the length of service of the HEPA filter.


- A filter replacement indicator.
- The ability to clean and replace filters and full collection bowls or bags without exposing the operators to dust, and
- A motor that draws at least 10 amps.

The hose should have a 1.5- or 2-in. diameter with a relatively smooth interior and a length of no more than 15 ft to provide adequate air flow.


The type of shroud to be used will depend on the preferences of the cement finisher and the employer, according to the task to be performed. After testing different types of shrouds, NIOSH determined that all were equally effective at reducing dust exposure by at least 90%.



The crew performing the implosion has to work with the municipality, and one of the many concerns the planning process has to address is preventing excessive crystalline silica exposure to both workers and people in the community. Silica exposure is one of the many factors taken into consideration when determining the evacuation zone; inhabitants or people working in the area who are allowed to stay in their offices are warned of the hazards for days ahead of the implosion. Then typically, immediately after the implosion, water starts being sprayed on the debris both as a fire-safety action and to settle the dust.

**Bottom Line**

This is what you DON'T want to see!




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8.5 Management and disposal

**Management and Disposal**

- Once cutting is done, the hazard goes away.
- Concrete/stone may be recyclable.
- Concrete/stone is considered a solid waste and managed as such.


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In its inert form, silica causes no related concerns. So, when possible, either reuse or recycle the concrete or stone. Otherwise, it just ends up in the local landfill, occupying a lot of space.

8.6 Further resources



For More Information


- NIOSH website:
<http://www.cdc.gov/niosh/topics/silica/default.html>
- OSHA fact sheet:
https://www.osha.gov/silica/factsheets/OSHA_FS-3683_Silica_Overview.pdf

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9 Treated Wood Debris


9.1 Terminology

Treated wood, or treated lumber, has had a preservative applied to delay the natural decay process.




Terminology

- There are three broad classes of wood preservatives:
 - Creosote—generally used in railroad ties, utility poles and pilings
 - Oil-borne preservatives such as pentachlorophenol and copper naphthenate—generally used for utility poles, assembly area roof supports, and glued laminated timber (a.k.a. glulam) construction




Continued on next slide

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Terminology

- Water-borne preservatives common in residential, commercial and industrial construction include:
 - Ammoniacal copper arsenate
 - Alkaline copper quaternary (ACQ-B and ACQ-D)
 - Ammoniacal copper zinc arsenate (ACZA) CCA
 - Copper boron azole (CBA-A) (CA-B)
 - Copper naphthenate
 - Sodium borate (SBX)




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Unlike the other materials covered in this curriculum, there are no tidy regulatory definitions for treated wood or lumber. Instead, treated wood is generally classified by the type of treatment done to preserve the wood.

Each of the three broad classes of wood preservatives outlined on the above slides have their own issues and concerns, which are addressed separately below.

9.2 History of use




History of Use

- 1700s: Mercuric chloride and copper sulfate recommended
- 1716: Earliest U.S. patent for wood preservative was issued by South Carolina to Dr. Wm. Cook
- 1815: Zinc chloride was recommended
- 1836: Use of coal-tar creosote patented
- 1838: Coal-tar creosote full-cell wood pressure treatment patented

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The main ingredient in Dr. Cooks' patented wood-tar formula was "Oyle or Spirit of Tarr." In 1836, a patent for coal-tar creosote was issued. But the big technological advancement came in 1838, when John Bethall developed a pressure impregnation process. The process involved: (1) an initial vacuum period, (2) a period for filling the chamber with preservatives, and (3) a pressure period during which time the preservatives were injected into the wood. The process works because when the air and moisture are removed from the chamber containing the wood, the wood cells (cell wall as well as the lumen or interior of the wood) are exposed, allowing for the pressure treatment to more easily impregnate the wood with the preservatives. The preservatives then impart to the wood a resistance to decay, fire, insects, and wood-boring marine animals. This early development formed the basis for modern pressure treatment techniques.



History of Use

- 1847: Pressure system developed using zinc chloride
- 1902: Empty-cell wood treatment process developed to lower costs
- 1928: Acid copper chromate (ACC) patented
- 1938: Copper chromium arsenate (CCA) patented
- 1950: Ammoniacal copper arsenate (ACA) patented

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Because oil was expensive at the turn of the twentieth century and an integral part of the creosote full-cell process, the empty-cell process was developed during 1902 in Germany. The empty-cell process is used when deeper penetration is needed but less retention is required. After that discovery, changes in the process have been primarily concerned with what substances are used rather than the pressure system technology itself.

9.3 Use by U.S. Army



Use By the Army

- Used anywhere they did not want the wood to rot!
 - Training areas
 - Bridges
 - Walkways
 - Play structures
 - Landscaping
 - Staircases
 - etc

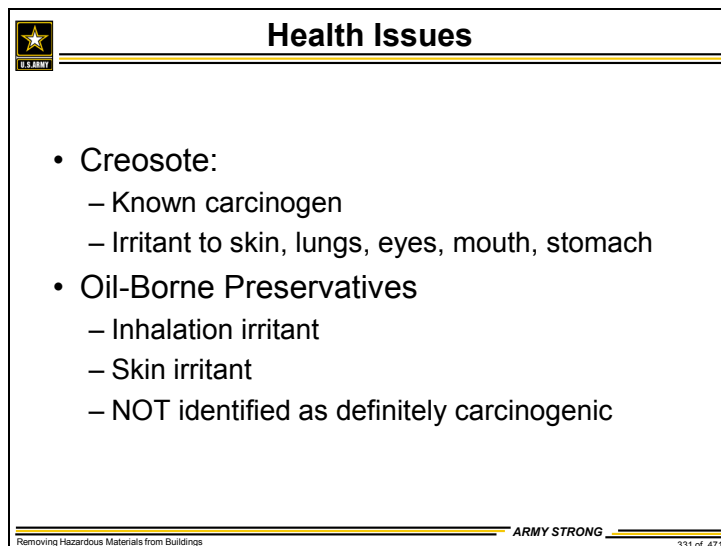


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9.4 Health issues

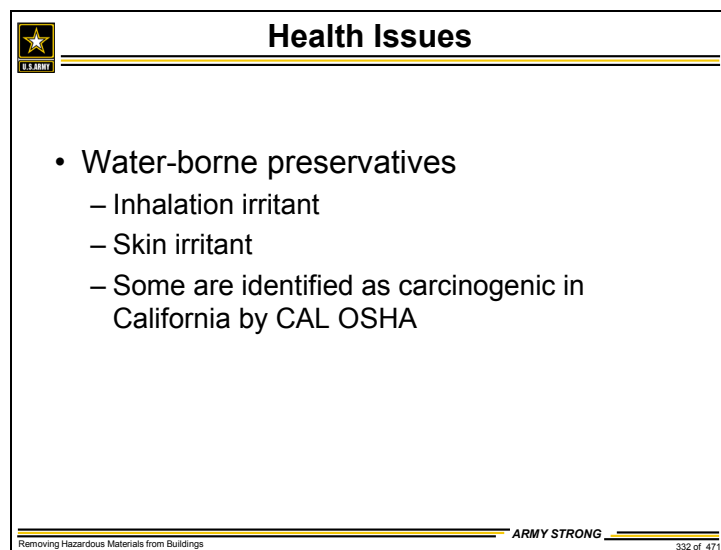


Health Issues

- Creosote:
 - Known carcinogen
 - Irritant to skin, lungs, eyes, mouth, stomach
- Oil-Borne Preservatives
 - Inhalation irritant
 - Skin irritant
 - NOT identified as definitely carcinogenic

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The SDSs for the various types of treated wood say that health effects are primarily focused on the dust/particles generated when cutting or installing the treated wood. It should be noted, therefore, that wood dust (treated or untreated) is considered to be carcinogenic.




Health Issues

- Water-borne preservatives
 - Inhalation irritant
 - Skin irritant
 - Some are identified as carcinogenic in California by CAL OSHA

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The last point in the above slide has to do with California Proposition 65 which has a somewhat broader/looser definition of the term “carcinogenic.”

9.5 Regulation



How Is It Regulated?

- EPA regulates the use of these various substances under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).
- OSHA regulates worker exposure to these wood preservatives for:
 - Workers manufacturing the treated wood.
 - Workers using the treated wood.

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Wood preservatives are regulated by two different agencies with separate, but complementary missions. OSHA is all about people/workers. EPA is about both human health and the environment. This difference means that EPA's human health concerns are not in the same context as OSHA's.

9.6 Demolition and repurposing concerns



Demolition and Repurposing Concerns



Thin Paints are Not Stains
no matter what the label (or the painter) says. They lack the clear transparency and soft depth of color of the true Stain, such as

Cabot's Creosote Shingle Stains
—the original shingle stains, which have been used, imitated and abused for sixteen years, and are still the standard. No muddy effects, or blackening, no lifeless colors—no *Keroline*, but Creosote, the "best wood preservative known." —*Transactor*.
 Send for Stained Wood Samples and Colored Shingles, Free.

PAULET. CAMPT, Sole Manufacturers, 45 Kilby Street, Boston, Mass.
 Agents at all central points.







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Where is creosote-treated wood found? Creosote is used as a fungicide, insecticide, miticide, and sporicide, and when creosote is applied by pressure methods it protects the wood in those ways. It is particularly effective

when applied to such products as utility poles and railroad ties. But in the past, creosote was also used in shingles and other structural components.

Creosote's use as a wood preservative was re-affirmed by EPA in 2008. But today, creosote-treated wood is intended for exterior/outdoor uses only. Its current commercial uses include railroad ties (70%), utility poles (15–20%), and other miscellaneous commercial uses (10–15%). In the United States, the use of brush-on creosote is no longer allowed.¹⁷

 Demolition and Repurposing Concerns		
• Creosote-Treated Wood		
CAS	Component	Percent (weight)
8001-58-9	COAL TAR CREOSOTE	100
194-59-2	7H-DIBENZO(C,G)CARBAZOLE	0.00-0.32
85-01-8	PHENANTHRENE	8.80-17.89
91-57-6	2-METHYLNAPHTHALENE	5.37-13.17
83-32-9	ACENAPHTHENE	5.72-9.46
206-44-0	FLUORANTHENE	3.39-9.17
91-20-3	NAPHTHALENE	0.73-10.81
86-73-7	FLUORENE	4.72-5.80
129-00-0	PYRENE	2.42-5.89
132-64-9	DIBENZOFURAN	2.71-4.80
90-12-0	1-METHYLNAPHTHALENE	2.08-5.21
120-12-7	ANTHRACENE	1.29-4.22
92-52-4	DIPHENYL	0.90-2.58
91-22-5	QUINOLINE	0.91-2.41
86-74-8	CARBAZOLE	0.59-2.35
218-01-9	1,2-BENZOPHENANTHRENE	1.02-1.91
496-11-7	2,3-DIHYDRO-1H-INDENE	0.00-2.76
56-55-3	BENZO(A)ANTHRACENE	0.94-1.56
192-97-2	BENZO(E)PYRENE	0.09-1.80
50-32-8	BENZO(A)PYRENE	0.08-1.10
208-96-8	ACENAPHTHYLENE	0.36-1.33
238-84-6	BENZO(A)FLUORENE	0.48-1.07
243-17-4	BENZO(B)FLUORENE	0.37-0.93

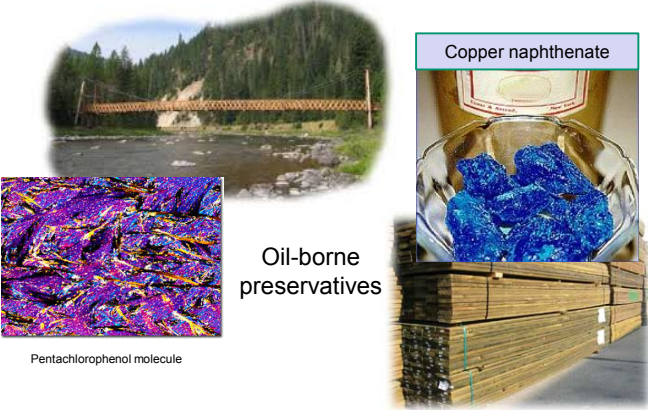
So if the EPA has approved creosote-treated wood, what's the problem?

The listing shown in the above slide is from an SDS for creosote-treated wood and represents only half of the chemical constituents listed by this particular manufacturer of creosote-treated wood. So, there is more than just creosote at issue in creosote-treated wood.

While there are minor variations between manufacturers in the substances they use to make creosote-treated wood, those variations are not significant enough to impact how creosote-treated wood must be handled.

¹⁷ <http://www2.epa.gov/ingredients-used-pesticide-products/creosote>

Demolition and Repurposing Concerns



Oil-borne preservatives

Pentachlorophenol molecule

Copper naphthenate

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The bridge pictured in the above slide is made of wood that is treated with pentachlorophenol. Pentachlorophenol is effective when used in treated wood that is going to be in contact with the ground (i.e., dirt), fresh water, or used entirely aboveground. It is not as effective when used in sea water.

The boards pictured in the lower right corner of the above slide have been treated with copper naphthenate. Like pentachlorophenol, copper naphthenate is not very effective in salt water. But unlike most wood preservatives, copper naphthenate can actually be purchased at some hardware stores and it can be used to touch up holes or other damage to structures. This fact suggests that, in some aspects, copper naphthenate seems to be considered slightly less of a health hazard.

Demolition and Repurposing Concerns

- Pentachlorophenol treated wood

*** Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS ***

CAS#	Component	Percent (weight)
Not Available	WOOD DUST, SOFTWOODS	>=98.8
68476-34-6	FUEL OIL (Meets AWPA P-9 Standards)	1.1*
64741-59-9	PETROLEUM DISTILLATES, LIGHT CATALYTIC CRACKED (Meets AWPA P-9 Standards)	1.1*
87-86-5	PENTACHLOROPHENOL	0.1
-	The above listed petroleum distillate contains the constituent(s) below	-
91-20-3	NAPHTHALENE	0.2


Component Related Regulatory Information

This product may be regulated, have exposure limits or other information identified as the following: Wood dust, all soft and hard woods, Wood dusts (all other wood dusts), Aromatic hydrocarbons, polycyclic (130498-29-2).

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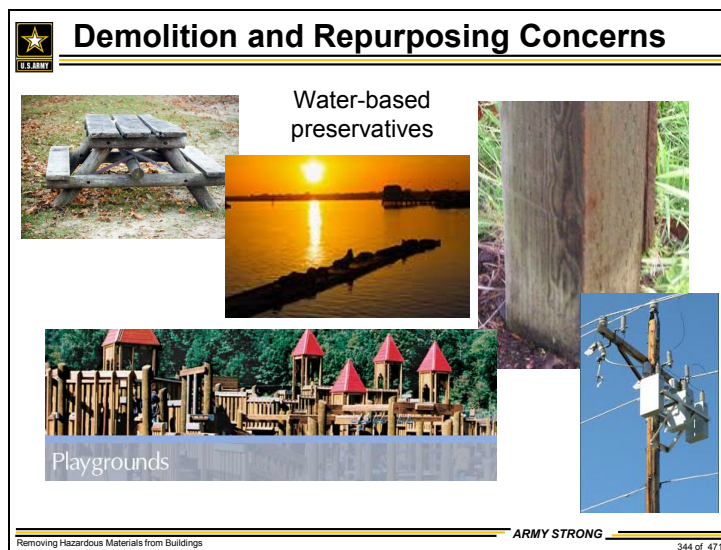
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Pentachlorophenol is used to treat wood (primarily poles) intended for industrial purposes. The information shown above is from an SDS that was published by a particular manufacturer, but all manufacturers have similar datasheets. This SDS illustrates what is actually used to treat the wood.


 Demolition and Repurposing Concerns					
<ul style="list-style-type: none"> • Copper Naphthenate 					
II. HAZARDOUS INGREDIENTS (See Section X Also)					
COMMON NAME	CHEMICAL NAME	CAS #	%	OSHA PEL	ACGIH TLV
Copper Naphthenate	Naphthenic Acid, cupric salt*	1338-02-9	0.05-4.0	N/E	1.0 mg/m ³ *
Petroleum Hydrocarbon	Fuel Oil	68476-30-2	0.01-20	N/E	N/E
Natural Wood Fiber	Wood, Natural (all species)	N/A	16-80	5.0 mg/m ³	5.0 mg/m ³

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As you can see from the above SDS for copper naphthenate, that treatment is slightly less complex than the pentachlorophenol treatment.


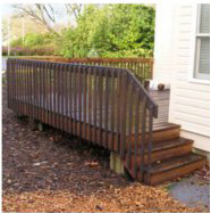


Wood treated with water-based preservatives can be found all over an installation.



Demolition and Repurposing Concerns

- Acid copper chromate (ACC)
- Chromated copper arsenate (CCA)
- Ammoniacal copper arsenate (ACA)
- Ammoniacal copper zinc arsenate (ACZA)
- Alkaline copper quaternary (ACQ)



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Each of the types of preservatives listed in the above slide is discussed below with information taken from Freeman et al. (2003).

Since the 1920s, acid copper chromate (ACC) has been sporadically used as a wood preservative in Europe and the United States. In the last few decades, ACC has primarily been used for the treatment of wood in cooling towers. Additionally, ACC is indicated in the American Wood Protection Association (AWPA) listings as suitable for above-ground sign posts, handrails, guardrails, and glue-laminated beams found in highway construction.

Chromated copper arsenate (CCA) has been in use since the 1940s and continues to be very popular.

Ammoniacal copper arsenate (ACA) was most commonly used on large-dimension wood products made from hard-to-treat wood species such as Douglas Fir.

In the 1980s some of the arsenic in ACA was replaced with zinc to form ammoniacal copper zinc arsenate (ACZA). ACZA is generally used for marine applications such as piers and docks. In general, it was also less expensive than ACA.

Alkaline copper quaternary (ACQ) was introduced in the 1990s and is considered an alternative to CCA because it does not include arsenic. ACQ is

registered for use on: lumber, timbers, landscape ties, fence posts, building and utility poles, freshwater and marine pilings, sea walls, decking, wood shingles, and other wood structures.

The characteristics of each of these preservatives are discussed below.

Demolition and Repurposing Concerns

- Acid copper chromate (ACC)
 - No arsenic
 - American Wood Protection Association (AWPA) indicates ACC is to be used for above-ground sign posts, handrails, guardrails, and glue-laminated beams in highway construction.
 - Also listed by AWPA for treatment of aboveground soft- and hardwood species.

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Interest is increasing in arsenic-free preservatives that rely on copper as the primary biocide (some CCA alternatives have co-biocides to help preserve against copper-tolerant fungi) (Lebow 2004).

ACC use has increased with EPA labeling changes. However at the moment, ACC does not have an EPA label, and its future availability is unclear.

Demolition and Repurposing Concerns

- Chromated copper arsenate (CCA) treated wood

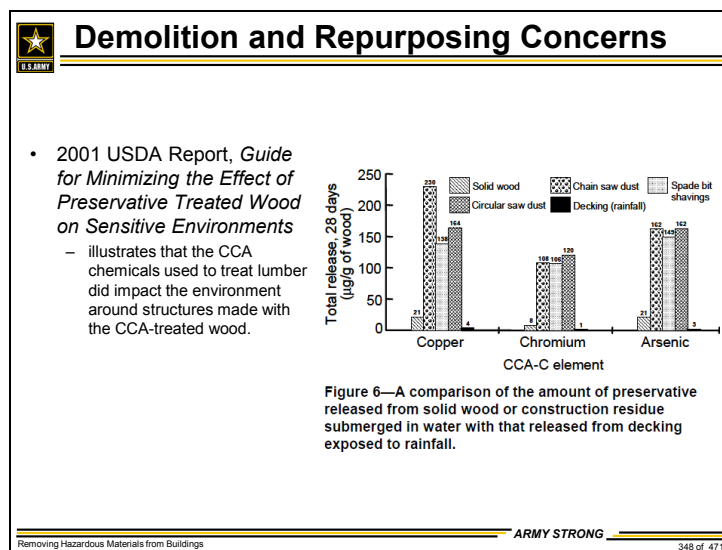
***** Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS *****

CAS#	Component	Percent (weight)
Not Available	WOOD DUST, SOFTWOODS	0 - 98.5
Not Available	WOOD DUST, HARDWOODS	0 - 98.5
7440-47-3	CHROMIUM	1.0 - 3.1
7440-38-2	ARSENIC	0.7 - 2.2
7440-50-8	COPPER	0.4 - 1.2

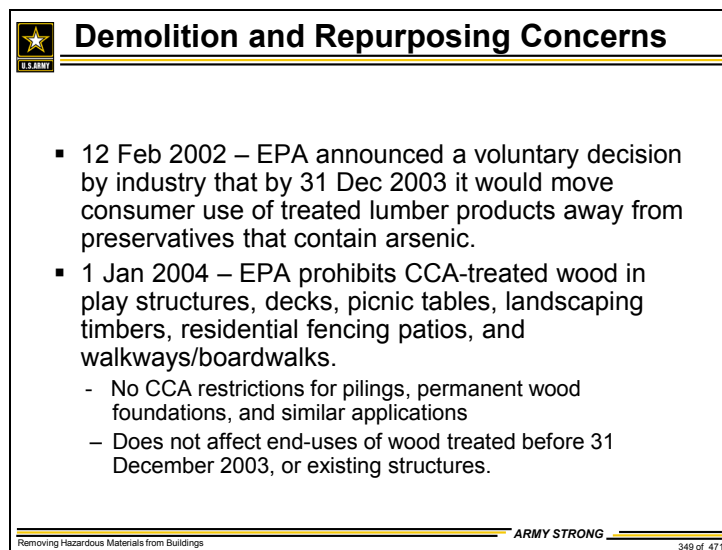
Component Related Regulatory Information
 This product may be regulated, have exposure limits or other information identified as the following: Wood dust, all soft and hard woods, Wood dusts-hard wood, Wood dusts (all other wood dusts), Wood dusts (birch, mahogany, teak, walnut), Wood dust, western red cedar, Chromium compounds, Arsenic compounds, n.o.s., Arsenic, inorganic compounds, Copper, inorganic compounds, Copper compounds, n.o.s..

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The segment in the above slide is taken from an SDS for pressure-treated wood and illustrates a common composition of CCA-treated wood, where copper is the fungicide component, arsenic is an insecticide, and chromium is added as a binder to glue ingredients to the wood.



A USDA report found that CCA did have a detrimental use on the environment surrounding the structures made with it (Lebow and Tippie 2001).



Currently, EPA has indicated that it does not believe there is any health-related reason to remove or replace existing CCA-treated wood structures, including decks and playground equipment. But, EPA has prohibited the use of CCA when installing new play structures, decks, picnic tables, landscaping timbers, residential fencing patios, and walkways/boardwalks.

While it would be nice, it is not necessarily accurate to think that if a treated wood item was installed after 1 January 2004 it won't be treated with CCA. And, it is well known that installations tend to be hoarders in case something can be reused. So, if it was a self-help project or built from materials in stock onsite, do not assume it is not CCA-treated wood.

Demolition and Repurposing Concerns

- Like CCA, both of the following types of wood treatment are classed as “inorganic arsenical pressure-treated wood:”
 - Ammoniacal copper arsenate (ACA)
 - Ammoniacal copper zinc arsenate (ACZA)

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Because ACA and ACZA are considered to be in the same class as CCA, the same health and use considerations exist.

Demolition and Repurposing Concerns

- Alkaline copper quaternary (ACQ)

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

TRADE NAME: ACQ treated lumber					
INGREDIENT NAME:	CAS	OSHA PEL	ACGIH TLV	OTHER	%
Wood/Wood Dust	N/A	5 mg/m ³ TWA	5 mg/m ³ TWA	N/A	90 - 98%
Monoethanolamine	141-43-5	3 ppm TWA 6 mg/m ³ TWA	10 mg/m ³ STEL 3 ppm TWA 6 ppm STEL	N/A	0.8 - 5.5%
Copper complex expressed as Copper Oxides	Proprietary	0.1 mg/m ³ TWA (fume)	0.2 mg/m ³ TWA (fume)	N/A	0.3 - 2.1
Alkyl dimethyl benzyl ammonium chloride*	68391-01-5	N/A	N/A	N/A	0.2 - 1.0%
Didecyl dimethyl ammonium chloride*	7173-51-5	N/A	N/A	N/A	0.2 - 1.0%
Didecyl dimethyl ammonium bicarbonate and Didecyl dimethyl ammonium carbonate*	Proprietary	None Established	None Established	N/A	0.2 - 1.0%

* Note: This product contains one of the above Quaternary ammonium compounds depending on which preservative is used at the treating plant.

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All ACQ types of wood treatment contain two active ingredients that may vary within the following limits: (1) copper oxide (62%–71%), which is the

primary fungicide and insecticide, and (2) a quaternary ammonium compound (29%–38%), which provides additional fungicide and insect resistance properties.

Following restrictions on CCA, use of ACQ has grown widely in the United States, Europe, Japan, and Australia. Its use is governed by national and international standards that determine the volume of preservative uptake required for a specific timber's end use.

As an interesting side note, Chemical Specialties, Inc. (CSI, now Viance) received the EPA's Presidential Green Chemistry Challenge Award in 2002 for the commercial introduction of ACQ. Its widespread use has eliminated major quantities of arsenic and chromium previously contained in CCA.

9.7 Management and disposal



Management and Disposal

- Storage
 - In 2001, USDA issued guidance on managing treated wood; primary points were:
 - Keep wood dust, and treated wood construction debris out of waterways
 - Protect treated wood construction debris from creating contaminated runoff
 - You have to know what your state regulations say!

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At the federal level, there are no storage regulations for treated wood unless the waste falls under the class “hazardous waste.” And the only guidance storing wood treated with creosote is in a 2001 document issued by the USDA (Lebow and Tippie 2001).

State requirements can be a different matter. For example, part of California's requirements say that C&D operations generating more than 1,000 pounds per month of what they call Treated Wood Waste (TWW), are required to:

- Get prior confirmation that the solid waste or hazardous waste disposal facility will accept the waste.
- Store the TWW off the ground by placing it on blocks, on concrete surfaces, or in containers.
- The TWW has to be covered in inclement weather to prevent leaching.
- If being stored on blocks, it cannot be stored more than 90 days.
- If being stored on concrete surfaces, it cannot be stored more than 180 days.
- If being stored in containers, it cannot be stored more than 1 year.



Management and Disposal

- Disposal of treated wood:
 - NEVER burn onsite.
 - Do NOT chip and use as mulch.
 - Determine if it is a hazardous waste:
 - Creasol hazardous waste codes are D023, D024, D025, and D026.
 - Arsenic hazardous waste code is D004.
 - Pentachlorophenol hazardous waste code is D037.
 - You must know the state-specific regulations

In most states, treated wood can be reused.

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Whether or not treated lumber can be disposed of in a solid waste landfill depends on whether or not it is a hazardous waste. The biggest factor in that determination has to do with the lumber's age and exposure. The longer it has been exposed to the weather, particularly rain, the less creosote there will be in the wood. Typically this kind of waste is not a hazardous waste.

States, of course, can apply their own disposal rules. For example, in New York state, wood treated with creosote from C&D activities can be disposed of as C&D debris waste in a permitted municipal solid waste (MSW) landfill that accepts C&D debris, or at a permitted C&D debris landfill, or burned in a permitted municipal solid waste or hazardous waste combustion facility. Wood treated with creosote is considered adulterated and therefore cannot be disposed of at a land clearing debris landfill.

As mentioned above, California has created an entirely separate category of waste—TWW. Similar to the idea of UW discussed earlier, in California, TWW is not the equivalent of hazardous waste; but neither is it solid waste or C&D debris. The California TWW regulations are not as stringent as hazardous waste regulations; but they are also not as liberal as solid waste regulations.

10 Mold

10.1 Terminology




Terminology

- Neither OSHA nor the EPA legally defines the term “mold.”
- Both OSHA and EPA provide guidance, but not regulations.

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In some ways, mold is like the proverbial elephant in the room that no one wants to talk about. Everyone works hard at preventing it and no one wants others to know it exists. With mold, there even is more than one elephant in the middle of the room.

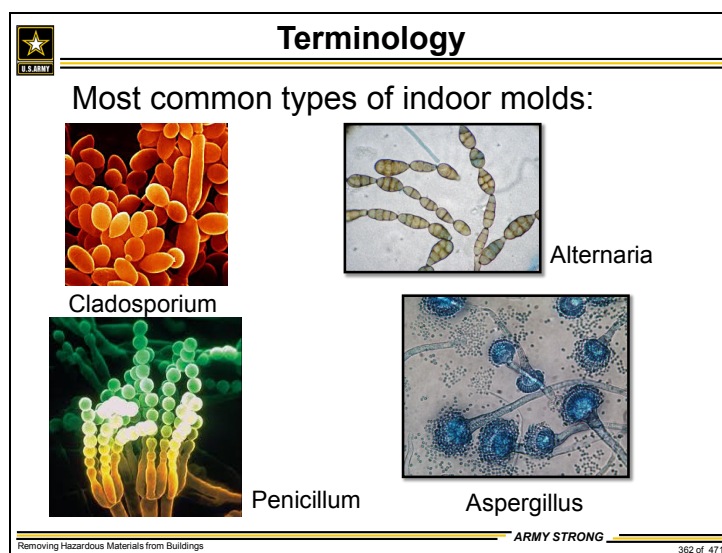


Terminology

- According to the CDC:
Molds are fungi that can be found both indoors and outdoors. No one knows how many species of fungi exist but estimates range from tens of thousands to perhaps three hundred thousand or more. Molds grow best in warm, damp, and humid conditions, and spread and reproduce by making spores. Mold spores can survive harsh environmental conditions, such as dry conditions, that do not support normal mold growth.

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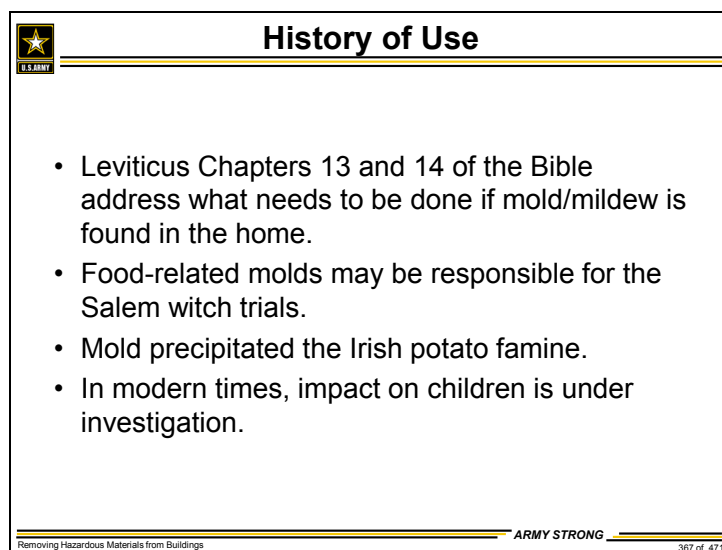
As the above slide shows, there are many options that create mold, and it is persistent.



As pictured above, the most common types of mold found indoors are:

- Cladosporium
- Penicillium
- Alternaria
- Aspergillus


10.2 History of use



Another aspect of mold that is far more recent than the historical mentions above is the part that mold can play in property transactions. In the past, it was not uncommon for a house not to sell because of mold/mildew issues. Now in some states, mold clauses are added to real estate contracts so that

if hidden, long-standing mold is discovered after the sale, the buyer has recourse to tag the seller for a share of the cleanup costs.

10.3 Health issues




Health Issues

“Excessive exposure to mold-contaminated materials can cause adverse health effects in susceptible persons regardless of the type of mold or the extent of contamination.”

-CDC June 2006

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The above quote comes from a report born out of the huge amounts of mold-contaminated debris generated by Hurricane Katrina and the mold contamination of structures still standing but not occupied after Hurricane Katrina (CDC 2006).



Health Issues

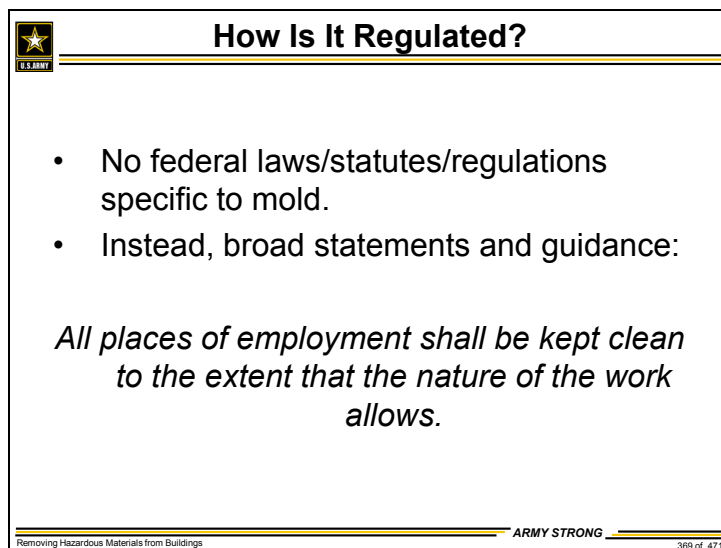
- Mold exposure may cause:
 - Asthma attacks
 - Respiratory infections/failure
 - Allergy symptoms
 - Skin irritation
 - Fungal infections

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Note that mold spores don't cause asthma, but they do irritate an existing asthmatic condition. In addition, when mold spores are inhaled by an immunocompromised individual, some mold spores may begin to grow on

living tissue, attaching to cells along the respiratory tract and causing far more serious problems.

10.4 Regulation



How Is It Regulated?

- No federal laws/statutes/regulations specific to mold.
- Instead, broad statements and guidance:


All places of employment shall be kept clean to the extent that the nature of the work allows.

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There have been attempts on the federal level by both EPA and OSHA to regulate the issue of mold, but both have stopped dead in their tracks. Instead, one is left with broad statements like the one on the slide above, and lots of guidance on what to do to prevent mold and how to deal with mold-contaminated debris.

On the other hand, some states actively regulate the presence of mold, how mold remediation is done, and the licensing of mold remediation specialists. Some of the states actively regulating mold include California, Florida, Montana, New Jersey, Oklahoma, Tennessee, and Texas.

10.5 Demolition and repurposing concerns

**Demolition and Repurposing Concerns**

Moisture + Temperature + Growing Media = Mold






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The short answer to where mold forms is anywhere that has the right amount of moisture, plus the right temperature, and something for the mold to grow on.

**Demolition and Repurposing Concerns**



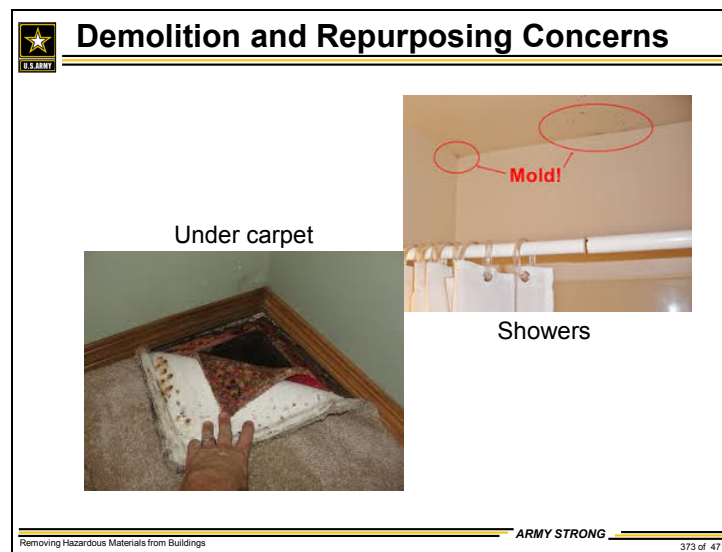
Water heater closets

Basements

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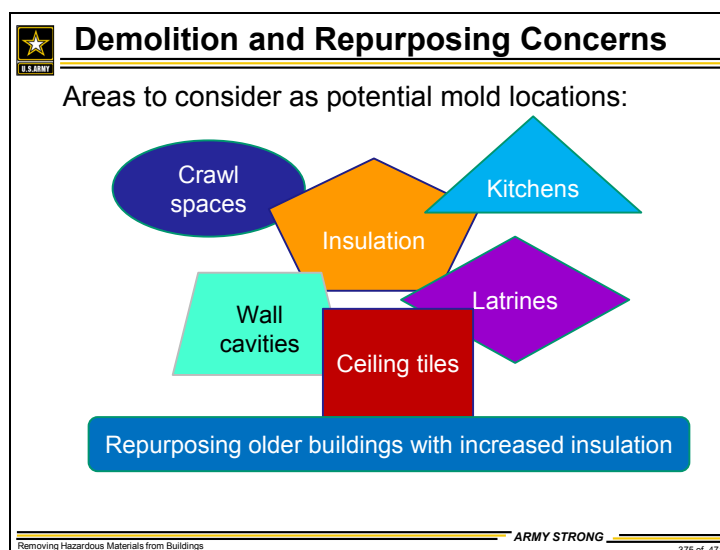
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Mold under the carpet is a good example of a hidden danger. If a project begins by ripping out carpet before checking underneath, workers may be exposed to mold.



Hopefully, no installation's rooms ever look like this one!



In addition to the examples pictured on the prior slides, the above slide points out general areas which need to be considered as potential mold locations.

10.6 Management

Management

- If demolishing the entire building, mold is probably not a major concern.
 - If there is extensive mold, contact local public health department for their guidance.
- When doing renovation or rehab, mold may be a human health concern.
 - Contact industrial hygienist (IH) for guidance
 - Consult CDC and EPA guidance.
<http://www.cdc.gov/mold/cleanup.htm>
<http://www.epa.gov/mold/moldguide.html>


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As the slide points out, if the entire structure is being demolished mold may not be an issue. If there are any concerns of any kind concerning mold however, both the installation's Industrial Hygienist and local public health officials should be able to help.

11 Problematic Materials


Problematic materials can include radioactive waste and orphan wastes. While not often considered, there may be sources of radioactive waste that have to be managed as a part of building repurposing or demolition. Orphan wastes are those items, solid or liquid, found in containers hidden in closets or high up on shelves that no one knows what they are.

11.1 Radioactive waste

**Storage And Disposal Of Problematic Hazardous Building Materials**

- Waste Tritium Exit Signs
 - If not expired, reuse it.
 - If expired, send it back to the manufacturer

Tritium Exit Signs
No Electricity!



Up to 20 year life span

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Many exit signs contain tritium, the radioactive form of hydrogen. Mixing tritium with a chemical that emits light in the presence of radiation, known as “phosphor in a tube” (a sealed source), creates a continuous self-powered light source. This useful property of tritium can be applied to situations where a dim light is needed, but where using batteries or electricity is not possible or practical.

Using tritium in exit signs ensures that the sign will remain illuminated in the event of an electrical outage or a fire. If the tubes in the exit signs are severely damaged, the tritium (which exists in the sign as a high temperature gas) might escape into the local area, but most likely it will quickly disperse in the air. Because a damaged exit sign will exhibit relatively high levels of tritium, it should not be handled.


While damage to tritium exit signs is rare, damage is most likely to occur when a sign is dropped during installation or smashed in the demolition of

a building. If not damaged during demolition, tritium exit signs sometimes become broken when they are illegally dumped in community landfills.

A tritium exit sign should be clearly labeled with a statement that it contains tritium.

Return outdated tritium exit signs to the manufacturer. The address of the manufacturer usually can be found on the back of the tritium exit sign. The manufacturer can provide instructions on how to ship the tritium exit sign safely.

11.2 Orphan waste

**Storage And Disposal Of Problematic Hazardous
Building Materials**

- “Orphan Waste” is NOT a legally defined term


— BUT —

- It is a commonly used term to described the odds and ends of things found abandoned in uninhabited buildings, behind buildings, ditches, etc

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While “orphan waste” is not defined in any federal or state regulations, it is a term that is often used to describe anything that has been abandoned. However, if abandoned waste is a pile of items dumped in the middle of nowhere, it is called open dumping!

Storage And Disposal Of Problematic Hazardous Building Materials




The applicable laws and regulations depends on what the material is!

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Hopefully installation personnel will never encounter the bottom two situations pictured above, but if it happens, this curriculum will have taught you what to do.

Storage And Disposal Of Problematic Hazardous Building Materials

- General, identifiable trash
 - Regulated as solid waste
- Batteries and fluorescent light bulbs
 - Regulated as universal waste
- E-waste (electronics, wiring, computer cables)
 - Depends on your state
- Household products (window cleaner, furniture polish, cleanser)
 - Depends on state/local policy




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Things like mattresses, food waste, and general debris can just go into the trash. If in suitable condition, items such as cardboard can go to recycling.




Electronic waste (E-waste) is classed as universal waste in some states, but in other states there is a completely separate e-waste regulation. For example, Michigan calls it a universal waste and requires it to be labeled and managed as such. But Illinois calls it e-waste and prohibits it from being placed in the general trash.

The category of household products can be tricky. If there are still contents in the containers and you are sure the contents match the label, put the products somewhere they can be used. In some states and municipalities, household products could also be considered “household hazardous waste,” and there is an entirely separate collection mechanism for those items.



**Storage And Disposal Of Problematic Hazardous
Building Materials**

- Unknowns (materials without a label, ancient materials, or materials with labels that are not trustworthy)
 - Until proven otherwise, these have to be handled as hazardous waste.






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An amazing variety of items can be encountered as orphan waste. Sometimes there will be one storage drum with a label that may or may not be legitimate. Sometimes an entire closet or room full of containers with no labels or completely faded labels will be found, with the prior occupants of the building have no idea where they came from.



**Storage And Disposal Of Problematic Hazardous
Building Materials**

- Look for orphan waste.
 - Open all closets and cabinets, look in all rooms prior to the start of repurposing or demolition.
- If it is solid waste that is disposable in the regular trash, do so. If not...
- Contact the appropriate person onsite for guidance
 - DPW Hazardous Waste Manager for unknowns
 - Medical for sharps, bloody waste, or pharmaceutical waste

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The most important step is to find orphan waste. Depending on the security of the site, looking for these orphans could be a daily activity. Construction or deconstruction sites seem to attract midnight “drop-offs” of old products and unknown substances.

It is important not to attempt to manage unknowns unless you have had extensive hazardous waste training.

12 Nonhazardous Solid Waste Disposal



Terminology

It's NOT PCB waste
It's NOT Asbestos waste
It's NOT Universal Waste
It's NOT Hazardous Waste
SO
What is it?

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12.1 Terminology




Terminology

- *Solid waste* – garbage, refuse, sludge, and other discarded solid materials resulting from industrial and commercial operations and from community activities. It does not include solids or dissolved materials in domestic sewage or other significant pollutants in water resources. (40 CFR 240.101)





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As shown above, this federal definition can easily include C&D waste.



Terminology

- **Bulky wastes** – large items of solid waste such as household appliances, furniture, auto parts, trees, branches, stumps, and other oversize wastes, for which large size precludes or complicates their handling by normal solid waste collection, processing, or disposal methods. (40 CFR 243.101)




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The other important federal definition that applies to solid waste applies to what is termed “bulky waste.” In some states, the separate phrase of “white goods” is used for appliances.



Terminology

- **Construction and demolition wastes** – the waste building materials, packaging, and rubble resulting from construction, renovation, repair, and demolition operations on pavements, houses, commercial buildings, and other structures. (40 CFR 243.101)




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Even though EPA regulation of C&D waste is pretty limited, the agency did define it. The above definition is a framework on which the states can expand or further delineate.

12.2 Health issues



Health Issues

- Provides refuge for vermin and related, potential sources of disease.
- Potential breeding ground for mosquitoes and related, potential sources of disease.
- Potentially contaminated runoff can further contaminate surface water, groundwater, or soil.




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12.3 Regulation




Regulations

- Solid waste is regulated at the federal, state, and local levels.
- Federal solid waste regulations address:
 - Solid waste storage parameters (40 CFR 243)
 - Where the solid waste can or cannot be sent for disposal (40 CFR 257)

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Regulations

- State and local governments regulate the same solid waste issues as the Feds, and may also address:
 - Plant waste
 - E-waste
 - Open burning of solid waste
 - Construction and demolition (C&D) waste
 - Carcasses

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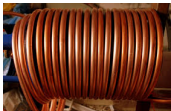
State and local regulators have gone beyond the federal regulations by addressing additional issues which may be dependent on local population and resources.

12.4 Demolition and repurposing concerns




Demolition and Repurposing Concerns

- Determine what waste being generated is recyclable in a cost-effective manner?
 - Metal wiring
 - Metal pipes
 - Concrete
 - Lumber
 - Plastic components



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Depending on location, recycling of certain materials may or may not be an option. If recycling is not an option, then disposal has to be considered.




Demolition and Repurposing Concerns


- In the case of disposal, determine if your state has their own regulations concerning C&D waste.
 - Then, determine if your municipal or county governments have their own regulations about C&D waste.
 - Then, if your state or other governments recognize the classification of C&D waste, find a C&D landfill that can take the C&D waste.

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Not every state has recognized the value of regulating C&D debris as a separate type of solid waste. If your state has, then you are in luck.




No matter how much waste can be classed as C&D waste or how much can be recycled, there **will** be solid waste, trash, garbage, etc.



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12.5 Management and disposal



Management and Disposal


- The solid waste (SW) storage requirements apply regardless of whether:
 - the SW is going to be reused as building materials,
 - the SW is going to be recycled,
 - the SW is going to be used in energy recovery, or
 - the SW is going to the landfill.

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Contrary to popular belief, there are regulations about the storage of debris, and those regulations apply regardless of whether the items will be reused or recycled, burned for energy recovery, or sent to the landfill.



Management and Disposal


- Must be stored so as not to cause a fire, health, or safety hazard.
- Bulky wastes are stored so as not to create a nuisance and to avoid the accumulation of solid waste and water in and around the bulky items.
- Bulky wastes do not sit around for more than 3 months.

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Except for the 3-month rule, the requirements for management and disposal of bulk solid waste are fairly broad and wide-open to interpretation. However, a local municipality may have narrowed that interpretation.



Management and Disposal

- Available SW containers must be of an adequate size and number to contain all waste generated between collections.
- ANSI standards for containers must be met.
- Reusable containers must be capable of being serviced without the collector coming into contact with the waste.

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However, containerized storage requirements are a bit more specific. In all likelihood, if a waste hauler is providing the container, it probably meets ANSI standards. Even so, containerized storage requirements are a good thing to include in a contract.



Management and Disposal

Not acceptable:



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13 Contracting for Removal of Hazardous Materials from Buildings

In this section, contracting issues associated with removing hazardous materials from buildings will be discussed.

The objective of this section is to familiarize students with processes involved in removing hazardous materials from buildings that are not specifically engineering-, scientific-, or health-related. However, the processes are critical to successfully executing a hazardous material removal project. A contract's provisions govern the performance of the Work. If the provisions are incomplete, ambiguous, or otherwise do not accurately describe the project's requirements, the results are not likely to be satisfactory and the project's objectives may not be achieved.

Note: In a contract context, “Work” (with a capital W) refers to the tasks to be performed, as described in the contract. It may be a use of jargon to an extent, but “Work” is a different connotation than “work” (small w), the latter referring to the word's common usage.


After completing this portion of training, the student should be able to understand:

- The basic contents of a contract involving the removal of hazardous materials from buildings; remediation, or abatement of the materials.
- How the contract should communicate the technical requirements of a project.
- How the contract should govern the administrative requirements (i.e. the execution) of the Work, addressing both the Contractor's and Government's obligations and responsibilities.¹⁸
- The general contents of a contract; what types of information are found in what parts of the contract.
- How project management personnel, and the environmental personnel supporting them, apply the contract throughout the execution of the Work.

¹⁸ Like “Work,” the terms “Government” and “Contractor” will be capitalized in this chapter only to distinguish their use in contracting from the more common ways they would be used.

13.1 General contracting

The following discussions will address some general contracting principles and the role of the DPW or USACE environmental, engineering, safety, and project management personnel.



Contracting, General


- Hazardous materials are removed from Army buildings through contracted services.
 - May be as an independent contact action.
 - May be defined as tasks within a more inclusive contract.
- Typically not performed with DPW in-house resources.

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Army installations almost always contract for removing hazardous materials from buildings; these tasks are rarely, if ever, performed with in-house resources. Therefore, it is important to understand contracting issues involved with these projects in addition to the health, regulatory, and engineering issues involved with removing these materials.



Contracting, General


- Relax!
- This is not a protracted discourse on contract law.

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Contracting is often perceived as a boring subject, based on legal jargon that only a lawyer can understand, and so complex that only a lawyer can learn it. This is hardly the stuff on which engineers, industrial hygienists, and project managers thrive. This section of the curriculum will not dwell on the “legalese” aspects of a contract for removing hazardous materials from buildings. The student will not see the phrase “... the party of the first part versus the party of the second part” or words like “estoppel” used in these discussions.

**Contracting, General**

- This is a discussion of how the contract relates to the design and execution of a project to remove hazardous material from a building — from the field perspective.

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Rather, this discussion focuses on the issues important to engineering, environmental, and project management personnel involved in the design and execution of a project to remove hazardous materials from buildings. This discussion represents the “field” perspective in developing the project’s requirements, and then ensuring the Work is being performed as required by the contract.



Contracting, General

- The government:
 - establishes requirements,
 - solicits, selects, and awards a contractor for services,
 - administers the contract; ensures compliance, and
 - closes out the contract.
- The contractor:
 - directs the work,
 - performs services according to the contract provisions, and
 - is compensated for performing the services.

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The Government (an Army installation in this case) requires hazardous materials to be removed from buildings. The contract is the instrument for communicating this requirement. Therefore, the Government holds the contract for these services.

The Government defines the project's requirements. The Government defines the problem through surveys, analyses, and other means. The Government develops the design and technical requirements to solve the problem, as well as how they will administer the project. The Government selects the Contractor through an established acquisition process. The Government then observes the project and ensures conformance to all provisions of the contract, technical and administrative. Once the Work is completed, the Government closes out (i.e. concludes) the contract.

The Contractor performs services to satisfy the Government's requirements, as the requirements are described in the contract. The Contractor is responsible for determining the methods to apply when performing the Work. The Contractor is responsible for proving to the Government that all Work conforms to the contract's provisions. The Contractor is compensated for their services as those services are described in the contract.

The Government is in charge; the Contractor is not. However, each party is assigned obligations and rights by the contract. Each party must observe the contract's provisions. It is the job of Army personnel administering the contract to ensure that both parties uphold their obligations and the problem is resolved.



Contracting, General

- Action to remove hazardous materials from buildings can be initiated through:
 - Installation's Asbestos Management Plan
 - Toxic Materials Management Plan or similar plans
 - USACE, as part of a broader construction, demolition, or building conversion/repurposing program
- Contract execution depends on the type of project.
 - OMA / SRM budget: typically executed through DPW, sometimes a USACE District
 - MILCON: executed through a USACE District
 - FRP: executed through the USACE Huntsville Engineer Support Center


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The installation must maintain an inventory of those buildings containing hazardous materials and have a plan to manage the materials. A TMT or similar body should be established to ensure a TMP or similarly titled plan has been developed, is current, and meets regulatory requirements. Inventory information in and of itself does not trigger an action to remove hazardous materials from buildings, but it does form the basis on which these actions are initiated.

There are essentially two ways in which a hazardous material removal action is initiated. The installation may initiate a project based on the TMP and the decisions of the TMT. There are a number of reasons such a project may be initiated. Discovery of a hazardous material in a building or discovery of environmental conditions that could create a health hazard to occupants can require a remedial action in response. However, within the context of this training curriculum, the primary motivator is removing hazardous materials before repair, conversion/repurposing, or demolition tasks can be performed. Initial action such as a survey or assessment, abatement design, or contract for removal can be initiated by the installation. Such actions would typically be supported through the installation's Operation and Maintenance, Army (OMA) or Sustainment, Restoration, and Modernization (SRM) budgets.

A building may be scheduled for conversion, or it may be repurposed for another mission. A building may also be scheduled for demolition, either to clear a site for subsequent new construction or to remove it from real property inventory. In the latter case, any hazardous materials present in

the building would not necessarily create a health hazard to occupants, as the building will no longer exist. However, environmental and occupational safety standards applied to demolition or construction will require these materials to be removed. Actions (surveys, designs, or contracts) would be initiated by USACE as a part of the project development process, and would be supported by MILCON, Facilities Reduction Program (FRP), or other major facilities programs.



Contracting, General


- Once signed, the contract obligates both parties (government and contractor) to its provisions.
 - If it's written in the contract, it will be done, but to the minimums required by the contract.
 - If it's not in the contract, it will not be done.
 - If it's not written in the contract, and you still want it, you'll have to modify the contract and pay extra for it.
- Emphasis: It is important to be completely and correctly explicit about the hazardous material removal requirements that you want in the contract.

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The contract is the sole instrument that communicates requirements between the Government and Contractor. Regulations, standard practice, engineering texts, best practices, experience, common sense, and other forms of information and wisdom that are not represented in the contract in some fashion are *not* obligatory. Work required by these sources, but not included in the contract, cannot be expected.



Contracting, General

- Contract is enforced by the Contracting Officer (CO) or their representative (COR)
 - CO may represent the installation or MICC.
 - CO may represent the USACE or other agency holding the contract.
- Project management requires knowledge of the project's
 - technical domain,
 - contract requirements,
 - recognition of conforming and nonconforming work
 - technical correctness, and
 - enforcement and discipline
 - per contract provisions.
- Requires authority to direct the contractor.

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Once a contract is enacted, the Government must oversee the Contractor's activities, ensure all requirements are being met, and ensure that desired results are achieved. This is the Government's fiduciary obligation to preserve the best interest of the taxpayer.

The Contracting Officer (CO) is the individual responsible for administering the contract on behalf of the Government. If the contract is held at the installation, the CO resides within the installation, often within the Mission and Installation Contracting Command (MICC). If USACE holds the contract, the CO resides within the USACE agency, typically a District. The CO delegates the day-to-day project oversight responsibilities to the Contracting Officer's Representative (COR), but with a more limited authority. These responsibilities are described in greater detail in Section 13.2 below.

13.2 Government personnel responsibilities

The following discussion summarizes the responsibilities of DPW or USACE environmental, engineering, and project management personnel in a remediation or abatement project.

**Government Personnel Responsibilities**


- Coordinates with other DPW offices regarding facility programs and remediation or abatement requirements.
- Ensures preparatory work is completed such as surveys, test results, assessments, etc.

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The DPW Environmental Division is typically the focal point when remediation or abatement projects are initiated.

If removing hazardous materials from a building is initiated by the installation, other DPW offices will be involved. These offices may include Master Planning, Engineering, Construction, Safety, and Contracting. If remediation or abatement is being conducted under MILCON, BRAC, Restationing, FRP, or similar facilities program, then USACE will also be involved, and coordination with the installation's USACE Project Manager Forward and Resident Office or Project Office will be required.

DPW Environmental Division personnel must ensure that all tasks and activities accomplished prior to initiating a contract are performed and correct. These tasks and activities may include performing surveys, compiling construction documents relevant to the Work, or performing environmental assessments required by regulation.



Government Personnel Responsibilities

- Develops or compiles requirements for performing the work, encompassing:
 - Scope,
 - regulatory requirements,
 - installation environmental manuals or guides,
 - technical requirements, and
 - procedural requirements.

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The project's scope is defined as what is to be included and what is not to be included within the contract. Scope should define the project's physical boundaries as well as all tasks and activities to be performed within the contract.

Statutes, regulations, and standards that apply to the materials in question and their removal, transportation, and disposal are compiled. These guiding documents will include federal and DoD sources (regulations, policies, guidance), and applicable state and local regulations.

Technical requirements for removing the materials in question from buildings must be developed. In addition to reflecting prevailing regulations, technical requirements will also involve the construction-related and occupational safety features of the Work. These requirements will all have to be included in the contract document.

Procedural and administrative issues necessary to successfully perform the Work also must be identified. These issues will be applicable to both the Contractor and the Government. Documentation must be identified to be developed and submitted by the Contractor, and then reviewed and approved by the Government.


**Government Personnel Responsibilities**

- Ensures appropriate requirements are incorporated into project contract documents so that they are:
 - technically correct,
 - free from omissions and ambiguities, and
 - defensible in the event of a claim or litigation.

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Once all requirements and provisions have been identified, it is then critical to ensure they are incorporated in the contract documents in a complete, correct, and unambiguous manner. Omissions, ambiguities, or discrepancies in the contract requirements can lead the Contractor to understand one thing, while the Government intends something different. Such discrepancies can jeopardize successful project execution, or at best create delays and additional expense until they are resolved. A Contractor can also exploit such discrepancies by interpreting requirements to their advantage, not the Government's, and then accrue additional payment through contract modifications. While the latter case should not occur, it can and it has.

The worst-case scenario is one in which the Contractor initiates litigation. In this case, the court system relies solely on what appears in the contract as it makes a decision for or against the Government.

**Government Personnel Responsibilities**


- Collaborates with other DPW or USACE offices regarding bidder/contractor qualifications and award.
 - Minimum qualifications if competitive bidding.
 - Evaluation factors if a best value source selection.

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Prior to awarding a contract, the CO (installation or USACE) may solicit DPW Environmental Division input regarding the technical qualifications of bidders (in a competitive-bid process) or proposers (in a best-value process). Those personnel who are knowledgeable about the subject materials and processes are best able to perform this evaluation. In a competitive-bid process, Contractors submit bids for performance of Work described in the contract document. The lowest bidder is awarded the contract. In a best-value source selection, competing Contractors develop their own proposals for performing the Work. The Government can balance price with other technical features of each proposal to determine which is the best overall value, with price AND other benefits considered. In this process, the contract award is not limited to the bidder with the lowest price.

In a competitive-bid solicitation, bidders must exhibit technical qualifications according to the contract's minimum requirements. The evaluation is confined to whether the bidder does or does not meet the contract's minimum requirements.

In a best-value solicitation, proposers must also provide information to describe their qualifications. These qualifications may include the criteria described above as well as other factors that distinguish between the minimally qualified proposers and the highly qualified proposers.

**Government Personnel Responsibilities**

- Reviews pre-construction submittals and work plans required by the contract for government approval (or supports other offices).
 - Verifies that plans meet requirements, are realistic, and if executed, will satisfy the project's requirements.
- Performs QA activities (or supports other offices).
 - Verifies work is performed correctly and in accordance with contract.
 - Identifies work that is deficient.
 - Ensures corrective work is performed as required.

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Government personnel must review submittals made by the Contractor prior to beginning the Work, as required by the contract. If the contract is held by USACE, these reviews will typically be conducted by a USACE Project Engineer, with support from Resident Office technical personnel. USACE personnel may also request support from DPW Environmental Division personnel. Review will address whether:

- plans sufficiently cover all requirements,
- applicable regulations are identified and will be observed,
- safety precautions will be put in place and applied throughout the project,
- proposed work methods and processes are reasonable and are likely to achieve the desired results,
- testing and quality control processes are identified and will be appropriate for the project, and
- other similar pre-construction plans have been made.


If approval is required, the reviewers should recommend approval, or they should identify deficiencies in these plans. Note that Government personnel must not describe how to revise plans. Revising a plan is the Contractor's responsibility.

Throughout the course of the Work, Government personnel are entitled to perform quality assurance tasks, as described in the contract. If the contract is held by USACE, these reviews will typically be conducted by USACE Resident Office personnel. Again, USACE personnel may request

support from DPW Environmental Division personnel. Quality assurance activities may include:

- participating in inspections,
- reviewing test results,
- monitoring environmental control procedures,
- monitoring regulatory conformance,
- identifying deficiencies, and
- ensuring corrective actions are taken.

Government personnel may also perform inspection, monitoring, and testing tasks independently of the Contractor. Note that Government quality assurance (QA) personnel should identify deficiencies but must not describe how to correct them; correcting deficiencies is the Contractor's responsibility.


**Government Personnel Responsibilities**

- Performs close-out activities such as documentation, clearances and certifications, etc.
 - Final inspections and acceptance of the completed work
 - Receipt of required documentation
 - Certification of clearance so that the site can be reoccupied
- The CO performs the fiscal close-out tasks.

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At the conclusion of the Work, Government personnel must ensure the Work is complete and satisfies all contract requirements, all documentation required by the contract has been submitted, and all clearances have been secured. Activities may include participating in final inspections, verifying that deficiencies are corrected, verifying that all final documentation required by the contract has been submitted to the Government, and other similar tasks. It is critical that final environmental testing has been performed and clearances have been received so that the building or site can be reoccupied and the planned building conversion or demolition tasks can proceed.

It is also critical that these close-out tasks are performed prior to final payment to the Contractor. Although the CO is responsible for authorizing final payments, any outstanding deficiencies or unsatisfied contract requirements must be brought to the CO's attention before final payment is authorized. Once the Contractor has been paid, there is little incentive for the Contractor to correct deficiencies. Note that having the Contractor provide all required final documentation is one requirement that is often overlooked. It is a common provision in the contract's payment procedures to keep a contract open for a nominal dollar value for some time after the physical work has been completed, for the purpose of maintaining the Government's authority over the contract.

**Government Personnel Responsibilities**


- The CO represents the government; the only one who has authority to change a contract, authorize payments, direct a contractor, and other similar actions.
- The government is represented in the field by a project engineer.
 - Serves as single point of contact between the government and the contractor.
 - Administers the contract from the government's side.
 - Serves as the COR, making recommendations to the Contracting Officer.
 - Typically supported by technical staff within USACE or the DPW.

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The CO represents the Government in a contract action. The CO (and only the CO) has the authority to make decisions regarding the contract. Only the CO can modify a contract, authorize payments, direct a Contractor, and take other similar actions. The CO is ultimately responsible for all contract activities as well as any repercussions and consequences that arise because of the contract.

In practical terms, however, a Project Engineer is the Government's representative on the jobsite. The Project Engineer essentially "runs" the project for the Government's side of the contract, within his or her own authority. The Project Engineer, whether USACE or DPW personnel, coordinates USACE and/or DPW resources, ensures the Government's tasks are completed and responsibilities are met, compiles information, and makes recommendations to the CO to implement. The Project Engineer cannot


direct the Contractor, although they can (and should) provide sufficient information to enable the CO to direct the Contractor. Examples include revising plans, ordering corrective or remedial action, authorizing change orders and developing contract modifications, issuing a stop work order, and similar actions. One action a Project Engineer is typically authorized to take unilaterally is to stop work when an imminent hazard is discovered. The USACE or DPW Environmental Division personnel support the Project Engineer in technical and administrative tasks such as test verification, quality assurance, cost estimating, and similar tasks.

**Government Personnel Responsibilities**

- Contractor should also have a single point of contact, often called the project manager.
- Communications between the government and contractor should only take place between these two points of contact.
 - Avoid confusing, conflicting, and inaccurate information from being passed to the contractor or to the government.
 - Avoid “implied authority.”
 - Help reduce the occurrence of contract disputes.

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For clarity and accuracy, information should be passed through the Project Engineer to the Contractor’s Project Manager. This one-on-one approach is not intended to inhibit useful communication, but rather to maintain an authorized avenue of communication and coordinate any potential actions that may result. USACE or DPW staff must not imply that they are directing the Contractor to take or not take any action outside of the contract’s Scope of Work, when in fact they do not have the authority to do so. Such an implication is called “implied authority,” and related action can be misinterpreted by the Contractor and could cost them time and money. It can also be used as leverage by the Contractor to file a claim based on believing “he told me to do such-and-such, so I did it, and it cost me more.”



Government Personnel Responsibilities

- Communications with the contractor are not prohibited, if it:
 - does not affect scope or compensation,
 - is for discussion only; not directive in nature, and
 - is emphasized that no action should be taken until authorized by the Contracting Officer.

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Communication is allowed, and discussions are good. However, the communication must be presented only as a discussion and not as directives. Any questions that arise or any suggestions made by either the Contractor or the Government can be discussed. However, discussion that suggests an impact on the Contractor's schedule or cost must always be qualified that the Contractor must take no action outside the contract Scope of Work until the issue is clarified by the Government. Daily reports and other project documentation must record such discussions in writing. Any such discussions should be documented in the project file.

13.3 Developing contract requirements

The following discussion will describe how requirements are developed and incorporated into a contract for removing hazardous materials from buildings, starting with answering "what is a requirement?".



Developing Contract Requirements

- Requirements for removing hazardous material from buildings are:
 - based on codified sets of methods and procedures,
 - applied to a defined scope of work,
 - communicated through contract requirements, and
 - enforced throughout contract execution.

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Requirements for removing hazardous materials from buildings are based on laws, regulations, standards, and other guidance promulgated by federal, state, and local authorities. Other forms of guidance may also apply that are based on protection of health and personal safety, engineering practices, and public policy. These may include agency and industry standards, technical or engineering guidance media, model or master guide specifications, and similar guidance outside of actual regulation. While they do not, in and of themselves, constitute contract requirements, they form the fundamental content of a contract's technical and administrative provisions.

These requirements are applied to the Work defined by the contract and what, by exclusion, is not to be performed. All tasks and activities included within the Scope of Work fall within the requirements of the contract.

Again, the contract is the sole means of communicating requirements from the Government to the Contractor, and thereby obligating both the Contractor and the Government. Once the contract is enacted, the contract's requirements must be observed throughout the project's duration. No other form of information or communication is binding to either the Contractor or the Government.



Developing Contract Requirements

- Sources of requirements
 - United States Code (U.S.C.)
 - United States Code of Federal Regulation (CFR)
 - State and local laws and regulations further qualifying Federal laws
- Regulatory agencies
 - US Environmental Protection Agency (US EPA)
 - US Department of Transportation (US DOT)
 - Consumer Products Safety Commission (CPSC)
 - Occupational Health and Safety Administration (OSHA)

When a federal law (also known as a statute) is passed, it is codified in the United States Code (U.S.C.). When a federal regulation is passed, it is codified in the CFRs.

Federal laws and regulations are the minimum standards that a state must meet in its own laws and regulations. But, the state has the option to regulate more stringently than is prescribed by federal laws and regulations, which is why it is important to always check state and local requirements.

The federal agencies listed in the above slide, and their state counterparts, are the agencies which regulate the issues discussed in this curriculum.




Developing Contract Requirements

- Additional sources of requirements:
 - DoD criteria, standards, regulations, etc.
 - Army Regulations (AR) and Technical Manuals (TM)
 - Unified Facilities Criteria (UFC)
 - Unified Facilities Guide Specifications (UFGS)
 - Industry standards
 - American Society of Testing and Materials (ASTM)
 - Underwriters Laboratory (UL)

Examples of criteria, standards, and regulations issued by the DoD and the Army include Unified Facilities Criteria (UFC), UFGS, Army Regulations (ARs), and Army Technical Manuals (TMs). These sources, in the context of removing hazardous building materials, define how the DoD is going to implement and perhaps go beyond the federal requirements.

Examples of Industry standards include those published by the American Society of Testing and Materials (ASTM) and Underwriters Laboratory (UL).



Developing Contract Requirements


- Scope of work provides:
 - explicit, definitive, unambiguous boundaries of the work.
 - What tasks are included, and therefore will be compensated.
 - What tasks are not included, and therefore will not be compensated.
 - Emphasis: Scope must include all tasks necessary to complete “the job,” whatever “the job” may be.

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The project’s scope must be defined so as to leave no doubt about the tasks and performance which are required of the Contractor. The scope forms the basis of a bidder’s estimate of the cost for performing the required services, and therefore the compensation they will expect if awarded the contract. Omissions or ambiguities in the scope will likely result in disputes when conducting the Work, which can jeopardize successful project results and incur additional cost to the Government.



Developing Contract Requirements

- Contract requirements must be:
 - technically correct;
 - Biddable, meaning that bidders must be able to accurately estimate a price for performing the services; and
 - executable, meaning that requirements are possible to accomplish, as written, from a technical and administrative perspective.

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Contract requirements must be technically correct. The requirements must accurately reflect all applicable regulatory requirements as well as recognized engineering and scientific knowledge and practice. The requirements also must be applicable to the solution of a problem and contribute to accomplishing the project's objectives. Technical requirements must not be burdensome or excessively rigorous without adding value to the project; avoid over-specification (that is, describing to a level of detail that exceeds the point of diminishing returns, adds no further value, and can even inhibit successful completion).

Contract requirements must be biddable. The requirements must be sufficiently clear so that a bidder can accurately estimate a cost for performing the services and submit a bid. Errors or misjudgment in developing bids are likely to manifest in difficulties due to the Contractor's funding shortfall; they can even lead the Contractor to seek opportunities for claims and litigation to recover costs.

Contract requirements must be executable. The requirements must be something a Contractor can accomplish within the recognized state of knowledge and practice. Impossible or unreasonable requirements (for example, requirements to use unavailable materials or equipment), contradictory or conflicting criteria, criteria that are not technically or scientifically sound, or criteria that are not recognized and accepted within the professional and regulatory communities are examples of un-executable requirements.



Developing Contract Requirements

- Contract enforcement means:
 - Requirements are unambiguous, meaning they are not subject to different interpretations.
 - Successful performance is recognizable through quantitative or qualitative means.
 - The government has the will and resources to enforce the contract.
 - Deficiencies are recognizable.
 - Corrective action is justifiable.

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Contract requirements must be enforceable. The word “enforce” often has negative connotations, as in something that results in punitive action. This connotation need not and should not be the case with a construction-type contract. Rather, the contract must be applied throughout the project. The Contractor should observe the contract’s requirements, as that is their business. The Government should oversee the Contractor’s work to ensure expectations are being met, as their duty to the taxpayer. However, it should not be an adversarial relationship.


Contract requirements must be sufficiently clear such that both the Government and the Contractor will have the same understanding of what is required. Successful performance must be measureable or observable, and deficient Work must be identifiable. The contract requirements must be sufficiently clear so that corrective actions can be justified and performed without disagreement.

Contract requirements must be applied throughout the project by the Government (USACE or Army installation). Otherwise, the contract is meaningless. The necessary activities to ensure conformance must be identified and incorporated into the contract requirements as part of the requirements development process. Resources must be made available to support these activities. Commitment to diligently perform oversight responsibilities must be ensured. Ideally, contract requirements are applied to accomplish the tasks at hand—which is to ensure the Government’s ob-

jectives are being met and the problem solved. In practice, however, contract requirements can also become the basis on which disputes and litigation are resolved.

13.4 Contract contents

This discussion will describe the various elements of a construction-type contract and how each part of the contract contributes to the successful execution of a remediation or abatement project.



Contract Contents

- In one form or another, a contract must include:
 - Bidding documents
 - Solicitation and procurement requirements and instructions
 - Instructions for submitting bids or proposals, project data, bid or proposal forms, agreement forms
 - Not technically a part of the contract, but critical to the contracting process.

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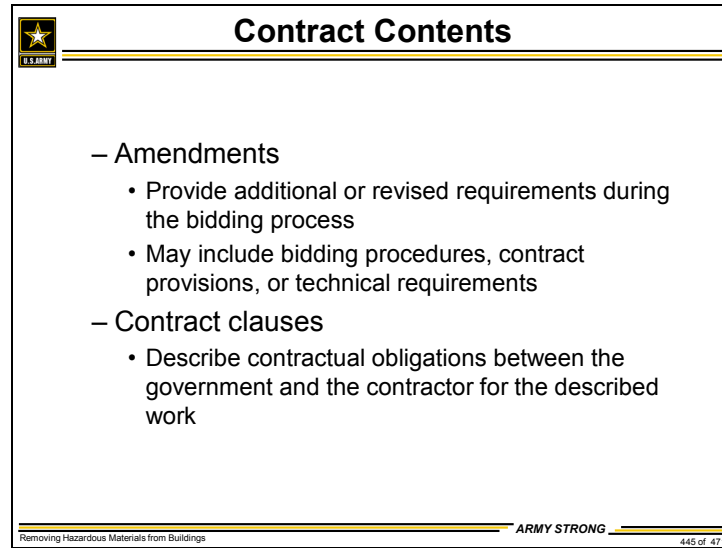
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Several formats are used for construction-type contracts. The Federal Acquisition Regulations (FAR) 15.2 describes a Uniform Contract Format and contents for each part of that format. The Construction Specifications Institute publishes MasterFormat, which organizes a contract's contents by construction materials and trades, and UniFormat, which organizes contract contents by building system. Non-building contracts (infrastructure, industrial facilities, etc.) organize contents by Codes of Accounts or Work Packages to align more closely with Work sequence or trades. Regardless of the format applied, a contract for removing hazardous materials from buildings must include certain elements.

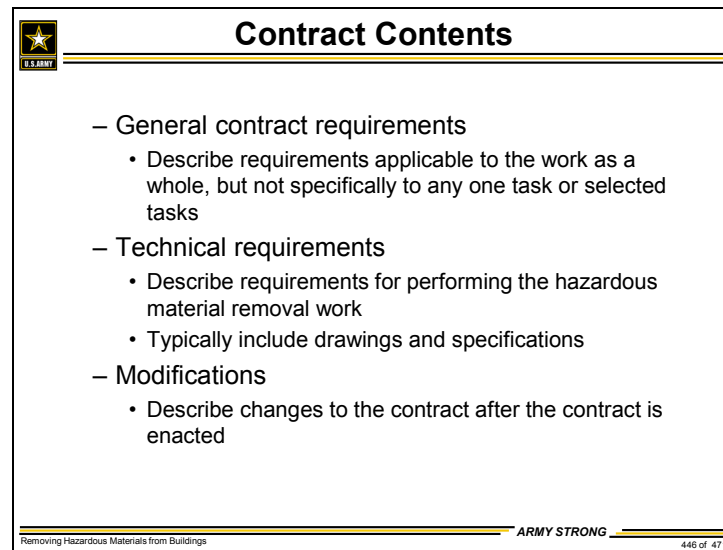
Bidding documents describe the solicitation processes and procurement requirements of the project. They provide instructions for submitting bids or proposals, project data applicable to developing a bid, bid or proposal forms, agreement forms, and similar information. Bidding instructions and documents are not strictly parts of a contract, however, as they apply to the project prior to enacting the contract. However, bidding documents

are a critical part of the contract process and can affect the contract's award if a challenge is filed by an unsuccessful bidder.



Changes in the bidding or contract requirements may be identified during the bid process. Such changes may include bidding procedures, contract provisions, or technical requirements. Revisions are transmitted to all bidders as amendments. Bidders must acknowledge receipt of amendments, signifying they are aware of the revisions, will adjust their bids as they see fit, and are prepared to execute the revised requirements in lieu of the original requirements. Amendments to the contract's contents become part of the contract.

Contract clauses are typically developed by the Contracts Office. They are taken from the FAR and describe the obligations of the Government and the Contractor when performing the Work. Contract clauses are often referred to as “boilerplate,” as they are applied to all contracts of a similar type. They are generally nontechnical in nature, describing the Government's policies and administrative requirements. Provisions typically include equal opportunity and affirmative action requirements, wage rates applicable to the project, conditions under which the Work may be suspended, environmental protection, buy-American provisions, conditions under which the Government may withhold payment to the Contractor, processes for modifying the contract, cost and data pricing practices for negotiating contract modifications, insurance and bonding requirements, payment procedures, health and safety management, and similar provisions.



General contract requirements apply to the project as a whole, but not necessarily to any specific task or material. The general requirements may further define or qualify contract clauses in the context of the specific project, and they are generally procedural in nature. General contract requirements may include:

- deadlines for beginning and completing the Work,
- conditions under which delays will be authorized,
- liquidated damages or penalties for late completion,
- submittal requirements throughout the project,
- development of record documents to portray the finished condition of the building or project,
- insurance coverage and bonding levels (further qualifying the contract clauses),
- description of utility services available to the Contractor,
- requirements to maintain a project schedule,
- Contractor quality control requirements,
- safety plan requirements,
- warranty provisions, and
- similar provisions.

Technical requirements describe requirements for performing the remediation or abatement Work. Technical requirements typically include drawings and specifications.

Drawings will portray:

- the boundaries of the Work,
- the building's configuration,
- existing conditions,
- the location of the hazardous material within the building,
- possibly original construction details, and
- other graphic information.

Specifications typically include information on:

- underlying regulatory requirements,
- methods and precautions required during hazardous material removal activities,
- quality control and testing requirements,
- environmental monitoring requirements, and
- other material-specific and task-specific requirements of the project.

Drawings and specifications may also refer to survey and test data that is either included in the contract document as an exhibit or appendix, or is included by reference and available from the DPW as Government-furnished data.



Contract Contents


- Solicitation and procurement requirements and instructions – why is this important to me?
 - Ensure project data is accurate
 - Existing conditions
 - Environmental assessments, survey reports, test results
 - Drawings, photographs
 - Ensure bid or proposal forms represent the Work correctly
 - Contract line items, numbers (CLINs)
 - Contract options
 - Ensure Representations & Certifications include appropriate Contractor qualifications and licensing requirements

Soliciting bids and managing the procurement process is essentially the CO's responsibility. However, input from subject matter experts (SMEs) should contribute to successful completion of the project.

It is critical that all information describing the project's existing conditions is accurate and all information necessary to perform the project is included. Such information may include current and accurate drawings of the site and buildings; photographs; assessments, surveys, and test data; available utilities (e.g., power, water, sanitary facilities); and similar information. If such information is missing or inaccurate, the occurrence of differing conditions or undiscovered materials can result in contract modifications, delays, Contractor claims, and additional expense to the Government.

The bid schedule may include multiple line items for which bidders must submit prices. The bid form may also include contract options that may be awarded with the base contract or that may be exercised later in the contract's execution. Ensure that the description of contract line items is accurate and represents a reasonable breakdown of the Work (i.e., it makes sense in the context of the project's overall requirements). Ensure that contract options are described accurately, that there is no ambiguity regarding Work to be performed within the base contract or any of the options, and that no tasks will be left incomplete if an option is not exercised.

Certifications and qualifications to remove, handle, and dispose of hazardous building materials will be required by regulation. Ensure that provisions are included in the solicitation requirements to verify the Contractor's qualifications and licensing and to verify that Contractor personnel are certified as required by regulation. DPW Environmental Division personnel may be involved in assembling this information for the Contracts Office to ensure it is included in the solicitation requirements as intended.




Contract Contents

- Incorporate any changes to contract requirements into amendments during the bidding process.
 - Still in the competitive environment.
 - Less costly to the government than contract modifications.

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All changes to the contract document that are known during the bidding process, prior to enacting the contract, should be issued to bidders as amendments while the project is still in the competitive environment. DPW or USACE Environmental Division personnel should forward recommendations for changes to the CO in a timely fashion to reduce the occurrence of contract modifications after the contract is awarded, at which time the Government is in a less-favorable negotiating position.




Contract Contents

- Contract clauses – why is this important to me?
 - Generally the clauses are compiled by Contracting Officer per Federal Acquisition Regulations.

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USACE or DPW Engineering Division personnel will typically have little involvement with the development of contract clauses.



Contract Contents

- General Contract Requirements – why is this important to me (cont'd) ?
 - While not technical per se, they have a direct bearing on the successful performance of the work.
 - Ensure that substitutions and change requests include evaluations to verify suitable performance will be achieved.
 - Ensure that discovery of undetected conditions are addressed appropriately from technical, safety, and contract administration perspectives.
 - Work stoppage and notifications
 - Analysis of the materials or conditions
 - Appropriate tasks and actions by the contractor
 - Scope and price adjustments; contract modifications if necessary

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General contract requirements are not technical requirements per se; they are not engineering or scientific in nature. However, they have a significant impact on how the technical requirements of a hazardous building removal project are applied and how conformance to the contract is monitored and verified. The successful completion of the project is dictated by the general contract requirements to a great extent. In that respect, the general contract requirements are equally as important as the technical requirements. The following examples illustrate relevance of general contract requirements to the successful completion of a hazardous building material removal project

Provisions allowing substitutions in materials and methods must include a thorough review of the proposed alternatives. Contractors must not be allowed to unilaterally substitute materials or methods described in drawings and specifications. Substitutions can be proposed, but they must provide comparable performance to the original material or method. Government personnel must verify that substitutions preserve the original design or specification intent.

Provisions for identifying conditions that differ from those indicated in the contract documents (construction drawings, survey results, Government furnished data, etc.) must describe the Contractor's and Government's actions. The Contractor must not be allowed to unilaterally perform work that may be out-of-scope, and then claim additional expense and seek additional compensation. Rather the Contractor should stop work at the affected location and inform the Government. The materials or conditions

must be documented and analyzed, and the Government must develop an appropriate resolution. If the agreed-upon tasks and actions alter the scope of work and/or compensation, a contract modification must be developed. Only then should the Contractor resume the affected Work.



Contract Contents

- Ensure site meeting provisions are appropriate for the specific project and tasks.
 - Meeting schedules; recurring and are convened for specific topics
 - Topics include safety and environmental controls
- Ensure safety management requirements address all regulatory and occupational safety requirements.
 - Safety measures, precautions
 - Accident Prevention or Hazard and Safety Plans
 - Hazard communication
 - Inspection
 - Documentation
 - Correction of deficiencies


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Communications between the Contractor and Government will be critical to successful project execution. Ensure that provisions for meetings are appropriate for the specific task and project. A preconstruction conference is highly recommended to ensure that all parties have common understanding and expectation for the project's objectives and requirements. Ensure that progress meeting are scheduled at the appropriate times (daily, weekly, or monthly), as required. Ensure that meetings will include discussions of the project's critical issues and progress such as safety, quality management, and environmental controls.

Ensure that provisions for developing, submitting, reviewing, and approving the Contractor's safety management plans are included. Ensure that requirements for accident prevention or hazard and safety plans, hazard communication processes, training, inspections, documentation, and deficiency correction are appropriate for the project. Ensure that provisions for ongoing safety management are required throughout the duration of the project.




Contract Contents

- Ensure contractor's quality control (QC) requirements are appropriate for the specific project and tasks.
 - Preparatory measures
 - Inspections
 - Documentation
 - Correction of deficiencies
- Ensure government's quality assurance provisions allow the government to adequately monitor contractor's QC activities and require corrective action if necessary.
 - Access to the work, independent inspections
 - Access to data and documents

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Contractor quality-control requirements must ensure that the Contractor's measures for monitoring the quality of the Work will be effective. These measures may include submittal of test data, preparation prior to beginning each activity, inspections throughout the Work, documentation of results, and detection and correction of deficiencies.

The Government's quality assurance processes must allow for sufficient oversight to ensure the Contractor is observing quality control requirements, the Work is performed correctly, deficiencies are corrected, and documentation has been provided. In addition to overseeing the Contractor's quality control process, the Government must be given access to the site and materials in order to perform their own inspections and tests, independently of the Contractor.



Contract Contents


- Ensure provisions for temporary facilities are complete and correct.
 - Responsibility for providing temporary facilities
 - Enclosures, barriers
 - Environmental controls
 - Cleanup and disposal
- Ensure the availability or nonavailability of utilities is clearly described.

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Removing hazardous materials from buildings will require barriers, enclosures, decontamination stations, hazardous waste storage areas, and other temporary items that are necessary to perform the Work, but which are not part of the Work left in-place. It is clear that the temporary facilities provisions must ensure the responsibility for providing and operating these items; typically the Contractor provides them as part of the Work.

Ensure that requirements are included to: remove these items upon completion of the Work, dispose of them, and restore the site to its original condition. If the installation will provide any other facilities for the Contractor's use (e.g., space for storage or a job-site office), these opportunities must also be described.

If water and/or electrical power is required for the project, the availability of water, sanitary, and electrical services to the Contractor must be described in the contract. These provisions must also address whether these required utilities will be provided at no cost, or whether the Contractor must meter these utilities and reimburse the Government. If required utilities are not available to the Contractor, then contract requirements must be clear that providing the utilities required for the Work (including sanitary facilities) will be the Contractor's responsibility and expense.



Contract Contents

- Ensure close-out requirements are appropriate to verify completion of the work and to maintain contractor responsibility until satisfactory work is verified.
 - Inspections
 - Correction of deficiencies
 - Clearance, certification
 - Documentation
 - Final acceptance procedures
 - Retainage
 - Contract closeout

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Closing out the contract will be critical to ensuring successful project completion. In addition to the fiscal close-out issues, ensuring that the Work is completed and conforms to the contract's requirements is of particular interest.

Ensure that close-out provisions address pre-final and final inspections, correction of punch-list items, and correction of all outstanding deficiencies. Ensure that all required testing and certification for re-occupancy have been completed. Air quality testing is of primary concern, although soil monitoring may be required in some cases. If the potable water supply has been shut off but will be reactivated upon re-occupancy, ensure that requirements for sanitizing and certifying the water distribution system are included.

Ensure that final acceptance provisions are appropriate for the project and allow the Government to maintain leverage over the Contractor until all obligations of the Contractor are met. Retainage—that is, retaining some portion of the Contractor’s payments until the contract is closed out—is one such method to maintain leverage.



Contract Contents

- Technical Requirements – why is this important to me?
 - The specifications – *as they appear in the contract* – govern the technical requirements of the project.
 - Basis on which bid or price proposal are based and contractor is compensated
 - Basis on which the work is judged to be satisfactory or deficient
 - Basis on which litigation is decided
 - Regulatory requirements must be represented in contract technical requirements (i.e., specifications).

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The technical requirements of a contract describe the work to be done and the specific criteria, characteristics, and properties of the materials and tasks to be performed. Technical requirements provide the “core” of the project from an engineering and environmental perspective. They also communicate the solution for removing hazardous materials from the building. Of all the elements of a contract, the technical requirements should most closely align with engineering, environmental, and safety personnel’s interests.

Prospective Contractors develop their bids or price proposals based on their understanding of the Work to be performed. They must define the activities and tasks required, and then estimate the materials, labor, and equipment resources required to perform these tasks. If the technical requirements are incomplete or inaccurate, the Work will not be completed as expected. Either the project will be completed in a less-than-satisfactory fashion, or the Government will pay more for contract modifications to upgrade the Work to the desired results, or both. None of these potential outcomes is desirable to the Government.

Because managing, removing, handling, transporting, and disposing of hazardous building materials are actions governed by statutes and regulations, it is critical that these actions are completely and accurately represented in the contract's technical requirements. Otherwise, the Government may be subject to a Notice of Violation and/or penalties from regulatory agencies.



Contract Contents

- USACE and/or DPW Environmental Division personnel may be tasked with developing project specifications.
- Technical requirements must be complete and technically correct:
 - to successfully accomplish the project's objectives, and
 - as a basis for assessing the contractor's conformance.
- Sources of technical requirements may include;
 - Local, installation-developed specifications
 - Unified Facilities Guide Specifications (UFGS)
 - Guide specifications, not contract-ready technical provisions
 - Must be edited and tailored for each individual project to represent specific project conditions

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The most important reason that technical requirements must be complete and accurate is to enable the successful accomplishment of the project's objectives—in other words, to solve the problem. Therefore, USACE or DPW Environmental Division personnel, who are involved with developing technical requirements or specifications, must be well versed in not only the technical subject matter, but also must ensure that specifications communicate the technical requirements to a Contractor in a complete and accurate fashion.

The technical requirements are also the basis for the Government's assessment of whether the Work is performed in a satisfactory manner or if deficiencies are present that must be corrected. USACE or DPW Environmental Division personnel involved with quality assurance activities will need a defensible, indisputable basis for identifying deficiencies and ensuring that corrections are directed by the CO.

Project specifications may be developed locally by the DPW. They may have been used frequently and proven to result in quality Work. Ensure that local specifications are appropriate for the project at-hand. Avoid copying specifications without thorough evaluation as to their correct application to specific project conditions and requirements.

Project specifications may be based on the UFGS. These are master guide specifications that have been vetted and approved by all of the DoD services. However, as guide specifications, they are not intended to be incorporated into contract documents verbatim. They include instructions to specifiers and guidance for establishing specific criteria, options, and blank spaces to be filled in by the project's specifier. Information not relevant to a specific project must be deleted, options must be selected, and information to be provided at the installation level must be included.



Contract Contents

– Relevant UFGS include:

- 02 81 00 *Transportation and Disposal of Hazardous Materials*
- 02 82 14.00 10 *Asbestos Hazard Control Activities*
- 02 82 16.00 20 *Engineering Control of Asbestos Containing Materials*
- 02 82 33.13 20 *Removal-Control and Disposal of Paint with Lead*
- 02 83 13.00 20 *Lead in Construction*
- 02 83 19.00 10 *Paint Hazard Abatement, Target Housing and Child Occupied Facilities*
- 02 84 16 *Handling of Lighting Ballasts and Lamps Containing PCBs and Mercury*
- 02 85 00.00 20 *Mold Remediation*

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The UFGS listed in the above slide are relevant to the removal of hazardous building materials. Depending on the specific requirements of the project, additional specification sections are likely to be needed.

If removing hazardous building materials is to be part of a larger demolition or renovation project, the UFGS listed above will constitute a relatively small part of the project's technical requirements in-total.

13.5 Specification contents

The following discussion describes technical specification content in general terms. Provisions applicable to each hazardous building material have been covered with that material.



Specification Contents

- Specification content
 - 3-part format:
 - Part 1–General
 - Provisions that govern the administration and management of the work within the scope of the individual specification
 - Part 2–Products
 - Properties of materials used in the specified work
 - Both materials left in-place and temporary
 - Part 3–Execution
 - Provisions that govern conduct of the work as it is performed

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The UFGS system has adopted the three-part format that was previously developed by the Construction Specifications Institute. Local installation-developed specifications may follow a similar format, or they may be composed in a more open format.

Part 1: General includes provisions that govern the administrative and management aspects of Work within that individual specification section's scope.

Part 2: Products provides the technical, engineering, and material properties of that feature of the Work. "Products" includes materials that will be left in place as well as materials that are applied temporarily and then removed.

Part 3: Execution includes provisions that govern the conduct of the Work as it is performed.

13.5.1 Part 1: General



Specification Contents

Examples: Part 1–General

- Payment procedures
 - Verifying quantities of materials removed and disposed of as part of the invoicing and payment process.
- References
 - Become part of the contract document by reference.
 - Referenced requirements must be applied and enforced during the work, even though they do not appear verbatim in the specification.
- System description
 - Describes scope and limits of specification.
 - What is included and not included.
 - What contractor is obligated to perform and, by exclusion, what they aren't obligated to perform.

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“Part 1: General” provides the administrative requirements of the individual section. Similar to the general contract requirements, Part 1 provisions are not necessarily technical in nature, although they do have a relevance to technical criteria. They frequently provide similar requirements as the general contract requirements, but directed solely to Work within the specification section. Selected examples are shown in slides that follow.

Payment procedures provide requirements to measure, and verify the quantity of work performed (typically a unit measure of a material or number of tasks), and processes for requesting payment. This will be especially important when USACE or DPW Environmental Personnel will participate in verifying the quantities of Work performed and developing recommendations for payment requests to the CO.

Regulations, standards, and other forms of guidance that apply to the specification section are cited. They are incorporated into the specification’s requirements by reference, and not copied verbatim. They are, however, parts of the contract and must be observed. USACE or DPW Environmental Personnel must be knowledgeable about the references, their contents, and applicability to the specification’s criteria.

The system description establishes the boundaries of the Work and what is to be included in the Work within a given specification. Ensure that the system description accurately and completely describes the Scope of Work within a given specification.



Specification Contents

Examples: Part 1–General (cont'd)

- Submittals
 - Documents, data, and other information the contractor provides to the government to verify conformance to specifications as the work progresses.
 - May be for review and approval by the government, or for information only.
- Quality assurance
 - Reference to quality control and quality assurance provisions in the general requirements.
 - Quality management measures within specification section; examples:
 - Qualifications of contractor, including all tiers of subcontractors and services
 - Provisions for laboratory testing
 - Records of regulatory citations
 - Meetings, reports, communications


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General requirements for submitting information and data to the Government are described in the general contract requirements. The submittal provision of the technical specification includes those specific documents, test results, monitoring equipment performance, certifications, and other information related to removing the subject material. Ensure that all such submittals necessary to verify conformance to the specification are explicitly cited in the submittal provisions. Ensure the submittal schedule is appropriate for the required tasks. If Government approval is required, ensure the submittal schedule allows the Government sufficient time for review and approval prior to the start of the activity.

The general contract requirements also describe the processes for the Contractor to develop and manage their quality control plan. The specifications provide the quality-control measures to be applied to the material and activities included in the specification section. These measures may include inspection procedures, laboratory testing, regulatory conformance, documentation of inspections, meetings and related communications, and similar requirements. They may also require qualifications for businesses or personnel involved with the specific material or tasks. It is critical that USACE or DPW Environmental Division personnel involved with quality-assurance activities are well versed in the specification's quality control and quality management provisions.



Specification Contents


Examples: Part 1—General (cont'd)

- Safety
 - Reference to safety management provisions in the general requirements
 - Safety management measures applicable to the specification section
 - Hazard analysis
 - Accident Prevention Plan or Health and Safety Plan
 - Abatement Plan
- Security
 - Licenses, permits, notifications
 - Site security and access
 - Regulated area boundaries, warnings

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Safety requirements applicable to the specified material or tasks will be included in the specification. The safety requirements may include hazard analysis, accident prevention plan, or a health, safety, and abatement plan. They will contribute to the overall safety management requirements described in the general contract provisions. Safety requirements may be communicated by referencing the appropriate safety standards and/or explicitly through specification language.

Security requirements that are applicable to the specified material or tasks will be included in the specification. Example requirements include licenses, permits, notifications, and security and access at selected areas of the project (or posted warnings).



Specification Contents

Examples: Part 1 General (cont'd)


- Medical Surveillance Requirements
 - Qualifications; Industrial Hygienist, Competent Person
 - Personnel exposure monitoring
 - Personal Protective Equipment selection, fitting
- Hygiene
 - Decontamination processes
 - Materials disposal
- Training Program
 - Training requirements
 - Verification, certification of training
 - Ongoing communications of safety and health precautions

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Medical surveillance and hygiene requirements applicable to the specific materials and tasks will be included in the specification section. These requirements may include the qualifications for an industrial hygienist and competent person, personal exposure monitoring requirements or PPE selection and fitting, decontamination procedures, or disposal of contaminated safety or protective clothing and equipment.

Training requirements applicable to the specific material and tasks will be included in the specification section. These requirements may include training prerequisites, verification or certification of training, and ongoing hazard communication and awareness training.

13.5.2 Part 2: Products



Specification Contents

- Examples: Part 2–Products
 - Expendable, disposable PPE
 - Disposal containers
 - Temporary enclosure materials
 - Air monitoring equipment
 - Equipment: filtration mechanisms, decontamination


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Of note in “Part 2: Products,” a hazardous building material removal project typically will not involve much in the way of new materials that are left in-place upon completion. However, specific materials applicable to the removal tasks and processes may be included in the specification section. The specific materials may include expendable and disposable materials required by the Work, disposal containers, temporary enclosure materials, air monitoring equipment, filtration mechanisms and decontamination processes, and similar items.

13.5.3 Part 3: Execution

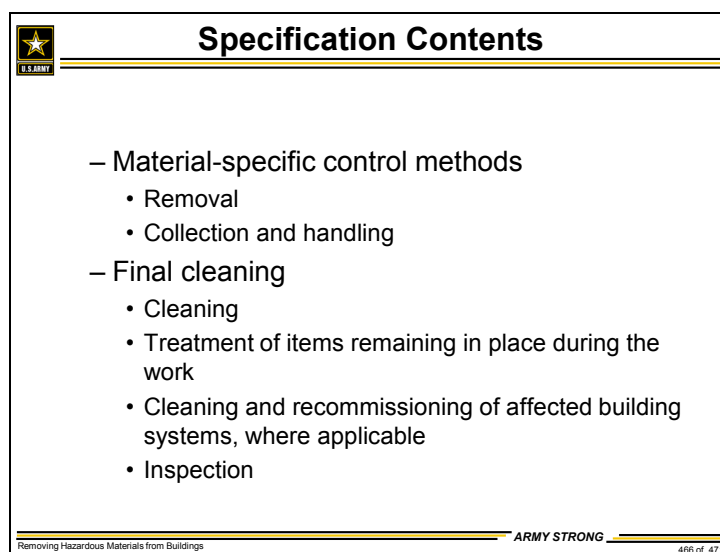
 Specification Contents
<ul style="list-style-type: none">• Examples: Part 3—Execution<ul style="list-style-type: none">– Barriers<ul style="list-style-type: none">• Work area enclosures• Protection of adjacent areas– Occupational protections<ul style="list-style-type: none">• Environmental controls• Personnel monitoring• Personal exposure limits and response• Assessments: preliminary, ongoing, final– Control methods<ul style="list-style-type: none">• Allowable or mandated• Prohibited
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“Part 3: Execution” will include requirements and criteria that govern the way the Work must be performed. These will include physical elements necessary for the work, as well as processes and procedures required to conduct the Work in a safe environment. Examples follow below.

Requirements for barriers will include demarcation of the Work area, warning signs, protective measures, and similar barriers to inform the public (the installation’s general population, in this case) of the hazardous nature of activities being conducted within the work site. Requirements will also be included for the enclosure of the building or areas therein. These barrier requirements may relate to: prevention of releases into the environment; air supply, exhaust, and filtration criteria; ingress and egress; and similar enclosure requirements. Requirements may also include provisions for physically protecting adjacent areas such as protection of vegetation and buildings.

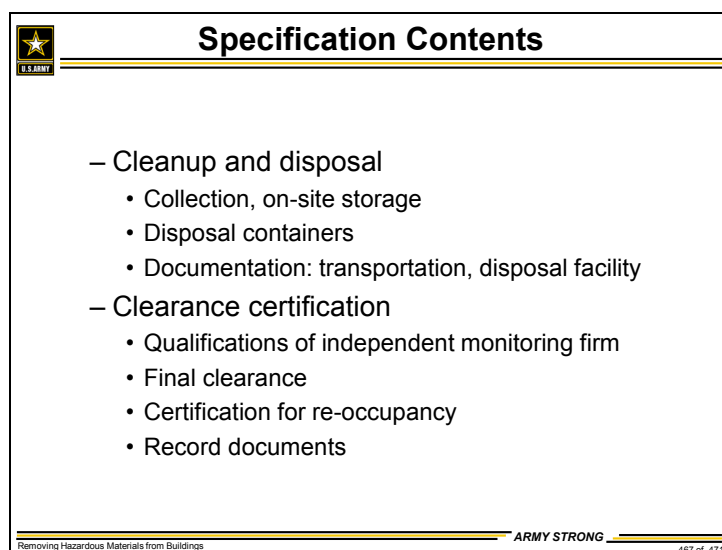
Requirements for the occupational safety of the workforce will include monitoring personal and ambient air for exposure to airborne contaminants, PPE, personal monitoring requirements, exposure limits and responses if the limits are exceeded, assessment schedules, spill or hazard response procedures, decontamination processes, and other similar requirements.

The means, methods, techniques, procedures, and sequences of performing the Work are generally the responsibility of the Contractor. The installation—through policy, experience, or regulatory directives—may require or prohibit certain methods or techniques. These requirements and prohibitions must also be defined in the specifications.



Criteria for removing, handling, transporting, and disposing of specific hazardous building materials will be addressed within that material's specification. (Further details for each material were included in the discussions of each specific hazardous material.)

If a building is to be reoccupied after hazardous materials are removed, such as with a conversion or repurposing project, the building must be free from contaminants. The specifications should include treatment and/or cleaning procedures for surfaces and equipment left in-place and inspection procedures to verify the building is cleaned to the applicable standards. Other building systems may require recommissioning upon completion of the hazardous building material removal activities; examples include disinfecting deactivated domestic water supply systems upon reactivation, recalibrating air distribution systems, and other similar activities.




Criteria for cleanup and disposal of hazardous and contaminated materials should include the collection and storage of waste on-site, construction and labeling of disposal containers, documentation required for transportation, permits or certification of the disposal facility, and similar provisions.

Clearance certifications must be secured prior to beginning subsequent conversion or demolition activities. Requirements may include the qualifications of the certifier, clearance and certification procedures, final inspection and acceptance procedures, and submittal of documentation to the Government.

13.6 Contracting summary

The following discussion describes technical specification content in general terms. Provisions applicable to each hazardous building material have been discussed with that material.



Summary

- Identify the problem
- Know the hazardous material removal requirements; provide to contracting agency.
 - Underlying regulations and standards
 - Project conditions
- Ensure requirements are incorporated into contract documents in the appropriate fashion.


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In summary, the following are the key issues related to developing and then administering a contract for removing hazardous building materials. They apply to both DPW and USACE environmental personnel involved with these projects, both in technical/engineering and in project management contexts.

- Identify the problem. Know the problem to be solved, the required solution, and the expected results of the hazardous building removal contract.
- Know the hazardous building material removal requirements. Know the underlying regulations and standards. Know the conditions that constitute the hazard, and the conditions that indicate the hazard is successfully removed. Know project conditions that may affect the performance of remediation or abatement tasks and activities.
- Ensure that all requirements are incorporated into the contract documents in a complete and unambiguous fashion. Ensure that, if a Contractor observes all contract requirements, the project will accomplish all of its objectives.



Summary

- Ensure the work is being executed in compliance with the contract requirements.
- Ensure required documentation is compiled and provided.
- Ensure all clearances, certifications, etc. are completed.
- Ensure the work is complete and the problem is solved.

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- Diligently observe the Work as it is being performed. Ensure it is being executed in compliance with all contract requirements, both administrative and technical. Apply methods allowed by the contract documents to ensure that deficient work is identified and corrected. If necessary, apply contract provisions to prevent the Contractor from continuing to perform unsafe or deficient Work, such as stop work orders, withholding of payment, or contract termination.
- Ensure that all documentation required by the contract is compiled and provided to the Government. Ensure the content of this documentation is correct and satisfies its purpose, as opposed to simply “checking a box.”
- Ensure that all clearances, certifications, and other forms of verifying compliance of all health and safety standards have been obtained, once the hazardous materials have been removed and the site cleaned.
- Ensure the Work is complete and the problem is solved prior to the fiscal close-out of the contract.

References¹⁹

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Department of Housing and Urban Development:**

24 CFR 35. “Lead-Based Paint Poisoning Prevention in Certain Residential Structures.”

29 CFR – Labor, Chapter XVII, OSHA:

29 CFR 1926. “Safety and Health Regulations for Construction.”

29 CFR 1926.62. “Lead in Construction.”

29 CFR 1926.1101(b). “Safety and Health Regulations for Construction, Toxic and Hazardous Substances: Asbestos, Definitions.”

29 CFR 1926.55. “Gases, Vapors, Fumes, Dusts, and Mists.”

29 CFR 1926.62. “Lead.”

29 CFR 1928. “Occupational Safety and Health Standards for Agriculture.”

40 CFR – Protection of the Environment, U.S. EPA:

40 CFR 61. “National Emission Standards for Hazardous Air Pollutants, Regulations.”

40 CFR 61.141. “National Emission Standards for Hazardous Air Pollutants, Definitions.”

40 CFR 61.141.51. “Maximum Contaminant Level Goals for Inorganic Contaminants.”

40 CFR 243.101.. “Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste.”

40 CFR 260.10. “Hazardous Waste Management System, General.”

40 CFR 261. “Identification and Listing of Hazardous Waste.”

40 CFR 261.32. “Hazardous Wastes from Specific Sources.”

40 CFR 261.33. “Discarded Commercial Chemical Products, Off-Specification Species, Container Residues, and Spill Residues thereof.”

40 CFR 273.9. “Standards for Universal Waste Management, Definitions.”

¹⁹ For regulations and standards, always consult the most recent guidance.

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Appendix A: Instructor's Manual

Part I: Introduction

Support and contacts

The *Removing Hazardous Materials from Buildings* workshop was funded by the Office of the Assistant Chief of Staff for Installation Management, Facilities Policy Division (OACSIM-ODF) to support OACSIM and the Army in matters regarding hazardous building materials and the provision of ongoing training. Managing the Army's Hazardous Building Materials program and policy is one of the major functions of OACSIM-ODF. The workshop curriculum and materials were developed by the U.S. Army Corps of Engineers (USACE), Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) in Champaign IL.

Syllabus

Course Objective: The objective of this course is to provide a workshop-style training curriculum that will enable installation operations and management personnel to identify, handle, and dispose of hazardous building materials in a safe, thorough, efficient, and economical manner. Doing so will support the OACSIM in matters regarding Hazardous Building Materials and provision of ongoing training.

Intended Audience: This course is directed toward an Army installation's Directorate of Public Works (DPW) personnel, typically in the Environmental Division. Personnel will be involved with surveying, recording, and controlling hazardous materials in buildings. They may also support Engineering Division and other DPW offices in performing building removal or repurposing tasks. This class will be equally applicable to USACE District personnel supporting the installation with Sustainment, Restoration, and Modernization (SRM) construction-type activities, or those executing military construction (MILCON) projects.

Course Format: This course will be delivered in a workshop setting. Presentations will be made, and discussions will be encouraged. Interaction between the instructors and the class will be critical. A pre-test will be given prior to the presentations to assess students' level of knowledge in the subject. A post-test will be given at the end of the class to assess how

successfully students learned the material presented in the course. A game show-style question and answer session will also be included as a diversion from the classroom routine.

Course Content: The course will address materials defined as hazardous to the environment and/or human health, and other materials that are problematic from a health, removal, or disposal perspective. Because an installation will almost always contract for services to remove hazardous waste from buildings, a section on contracting is also included. The focus of this course is removing hazardous building materials when demolishing buildings or when repurposing or converting buildings to a new function or occupancy. Some regulated materials may also be incorporated into new construction, however, so these are also addressed.

The course includes the following topics:

- Course Introduction
- Class Introduction
- OACSIM PWTB 200-1-144, Toxics Management
- Asbestos
- Lead-Based Paint (LBP)
- Polychlorinated Biphenyls (PCBs)
- Silica
- Treated Lumber
- Mold
- Miscellaneous Waste
- Solid Waste Management
- Contracting
- Course Evaluation

For consistency in the type of information and level of detail presented for each hazardous building material, the following will be discussed within each section, as applicable:

- Terminology
- History of use
- Use by the Army
- Health issues
- Regulation
- Demolition and building repurposing concerns

- Detection
- Management and disposal

Course Completion: At the conclusion of this course, each student will be able to:

- Identify hazardous building materials.
- Identify applicable laws, regulations, and standards.
- Describe practices, tasks, and control measures involved in removing hazardous building materials.
- Be familiar with the contents and applications of contracts to remove hazardous building materials.

Successful completion of this course will require the student to be attentive to the instructors and class materials; contribute their questions, experiences and observations to class discussions; successfully complete the post-test; and complete a course evaluation.

Points of Contact:

Instructor: *[To be added for each class.]*

OACSIM: Liisa White
OACSIM-ODF
liisa.m.white.civ@mail.mil
571-256-9775

Instructor Biographies

Instructor:

Photograph

Instructor Notes

[Insert instructor biographies and photographs above as needed.]

Schedule

Day 1: Morning

- Instructor Introduction
- Course Description
- Class Introduction; students' backgrounds, job descriptions, interests, and expectations for the workshop
- Pre-test
- OACSIM PWTB 200-1-144, "Toxics Management"

Day 1: Afternoon

- Asbestos
- Lead-Based Paint (LBP)

Day 2: Morning

- Polychlorinated Biphenyls (PCBs)
- Silica
- Treated Lumber
- Mold
- Miscellaneous Waste
- Solid Waste Management

Day 2: Afternoon

- Contracting
- Exercise: Hazardous Material Quiz Time!
- Post-test
- Course evaluation
- Wrap-up

Instructor Notes

Travelers should schedule two full days for this workshop. The second afternoon may conclude early, depending on the pace of the class and time taken for the exercise and post-test.

Morning and afternoon sessions are shown for illustration. The instructor should schedule sessions, breaks, and lunches as appropriate for the pace and progress of the class.

Appendix B: Pre-Test/Post-Test/Evaluation Form

Pre-Test

Instructor's Notes

Copy this pre-test separately and distribute to the class before any instruction begins.

1. **Which of the following would NOT require the removal of hazardous waste from buildings?**
 - a. Encountering a hazardous material while repairing electrical equipment
 - b. Demolishing a World War II (WWII)-era building
 - c. Demolishing a building constructed after 1979
 - d. Constructing a new building
 - e. Repurposing a building from one occupancy to another
2. **Use of asbestos is completely banned in construction material today. (*True or False*)**
 - a. True
 - b. False
3. **Friable asbestos must be removed from buildings prior to demolition in all cases. (*True or False*)**
 - a. True
 - b. False
4. **Which of the following federal agencies regulate ACM removal projects?**
 - a. Centers for Disease Control and Prevention (CDC), EPA, and OSHA
 - b. EPA and OSHA
 - c. EPA
 - d. HUD

5. **Who is required by regulation to receive notification prior to an ACM removal project?**
 - a. Regional EPA Office of Federal Facilities Enforcement
 - b. County Department of Public Health
 - c. State environmental regulatory agency
 - d. Local fire department
6. **Which federal agency has responsibility for regulations to reduce exposure to the toxic effects of lead from lead-based paint?**
 - a. Occupational Safety and Health Administration
 - b. U.S. Department of Housing and Urban Development
 - c. Occupational Safety and Health Act
 - d. Environmental Protection Agency
 - e. Consumer Products Safety Commission
 - f. All of the above
7. **Which the most important factor in determining when to remove lead-based paint from the surfaces of an Army building?**
 - a. Lead contamination in dust on floors and window sills
 - b. Whether lead level exceeds 1.0 milligrams of lead per square centimeter
 - c. Condition of the paint
 - d. Age of the structure
 - e. Whether the building is classified as either target housing or a child-occupied facility
 - f. Breakdown of the paint due to UV exposure
8. **In 1991 the Secretary of the Department of Health and Human Services called _____ the “number one environmental threat to the health of children in the United States.”**
 - a. Asbestos
 - b. Treated lumber
 - c. Mold
 - d. PCBs
 - e. Lead

9. **What federal law controls PCB management?**
 - a. Clean Air Act
 - b. Toxic Substances Control Act
 - c. Resource Recovery and Conservation Act
 - d. Clean Water Act
 - e. Federal Insecticide, Fungicide, and Rodenticide Act
10. **Why were PCBs added to common construction products?**
(Select all that apply)
 - a. Color
 - b. Thermal stability
 - c. Odor
 - d. Elasticity
11. **Any PCBs found in building products must be removed.** *(True or False)*
 - a. True
 - b. False
12. **What agency is responsible for definitions of PCB-containing wastes and disposal requirements?**
 - a. USACE
 - b. U.S. EPA
 - c. State environmental regulators
 - d. Local units of government
13. **Mercury-containing equipment or fluorescent lamps are classified as what?**
 - a. Solid waste
 - b. Universal waste
 - c. Hazardous waste
 - d. Special waste
14. **Which of the following methods of disposal is never acceptable for treated wood?**
 - a. Recycling
 - b. Disposal as hazardous waste
 - c. Burning

15. **Which Federal agency regulates the management of mold?**
 - a. EPA
 - b. OSHA
 - c. Department of Health and Human Services
 - d. CDC
 - e. None of the above
16. **Management and disposal of solid waste is regulated by which of the following?**
 - a. Federal EPA
 - b. State EPA equivalent
 - c. County government
 - d. Municipal government
 - e. All of the above
17. **What is the legally binding document that governs the performance of a project to remove hazardous materials from buildings?**
 - a. Universal Building Code
 - b. United States Code
 - c. Occupational Safety and Health Act
 - d. Project Contract
 - e. National Emissions Standards for Hazardous Air Pollutants
 - f. Toxic Substances Control Act
18. **The authority to make decisions regarding a contract's scope and/or compensation resides with whom?**
 - a. Contractor's Project Manager
 - b. Contracting Officer
 - c. Resident Engineer
 - d. Contracting Officer's Representative
 - e. DPW Engineering Division Chief
 - f. USACE District Engineering Division Chief
19. **The contract clauses for a contract to remove hazardous materials from an Army building are taken from which source?**
 - a. Federal Register
 - b. Contract Law by Mark Roszkowski, Esq.
 - c. Uniform Commercial Code
 - d. Unified Facilities Criteria

- e. Federal Acquisition Regulations
 - f. Engineer's Joint Contract Documents Committee
20. **You notice that the contractor, despite repeated warnings and directives, is still not placing hazardous materials in the appropriate containers and locked enclosures. What actions might the Contracting Officer take?**
- a. Issue a Stop Work Order
 - b. Withhold payment
 - c. Terminate the contract
 - d. All of the above
 - e. None of the above
21. **Which of the following will NOT be part of the contract close-out process?**
- a. Site cleanup
 - b. Verification that all deficiencies are corrected
 - c. Final inspection
 - d. Air quality certification
 - e. Final payment invoice
 - f. Contractor Quality Control Plan submittal and approval

Pre-Test with correct answers highlighted

1. **Which of the following would NOT require the removal of hazardous waste from buildings?**
- a. Encountering a hazardous material while repairing electrical equipment
 - b. Demolishing a WWII-era building
 - c. Demolishing a building constructed after 1979
 - d. Constructing a new building**
 - e. Repurposing a building from one occupancy to another
2. **Use of asbestos is completely banned in construction material today (*True or False*)**
- a. True
 - b. False**

3. **Friable asbestos must be removed from buildings prior to demolition in all cases. (True or False)**
 - a. True
 - b. False
4. **Which of the following Federal agencies regulate ACM removal projects?**
 - a. CDC, EPA, and OSHA
 - b. EPA and OSHA
 - c. EPA
 - d. HUD
5. **Who is required by regulation to receive notification prior to an ACM removal project?**
 - a. The federal Regional EPA Office of Federal Facilities Enforcement
 - b. County Department of Public Health
 - c. State environmental regulatory agency
 - d. Local fire department
6. **Which Federal agency has responsibility for regulations to reduce exposure to the toxic effects of lead from lead-based paint?**
 - a. Occupational Safety and Health Administration
 - b. U.S. Department of Housing and Urban Development
 - c. Occupational Safety and Health Act
 - d. Environmental Protection Agency
 - e. Consumer Products Safety Commission
 - f. All of the above
7. **Which the most important factor in determining when to remove lead-based paint from the surfaces of an Army building?**
 - a. Lead contamination in dust on floors and window sills
 - b. Whether lead level exceeds 1.0 mg of lead per square centimeter
 - c. Condition of the paint
 - d. Age of the structure
 - e. Whether the building is classified as either target housing or a child-occupied facility
 - f. Breakdown of the paint due to UV exposure

8. In 1991 the Secretary of the Department of Health and Human Services called _____ the “number one environmental threat to the health of children in the United States.”
- a. Asbestos
 - b. Treated lumber
 - c. Lead
 - d. PCBs
 - e. Mold
 - f. Silica
9. What Federal law controls PCB management?
- a. Clean Air Act
 - b. Toxic Substances Control Act
 - c. Resource Recovery and Conservation Act
 - d. Clean Water Act
 - e. Federal Insecticide, Fungicide, and Rodenticide Act
10. Why were PCBs added to common construction products?
(Select all that apply)
- a. Color
 - b. Thermal stability
 - c. Odor
 - d. Elasticity
11. Any PCBs found in building products must be removed. (True or False)
- a. True
 - b. False
12. What agency is responsible for definitions of PCB-containing wastes, and disposal requirements?
- a. USACE
 - b. U.S. EPA
 - c. State environmental regulators
 - d. Local units of government
13. Mercury-containing equipment or fluorescent lamps are classified as what?
- a. Solid waste
 - b. Universal waste

- c. Hazardous waste
 - d. Special waste
14. **Which of the following methods of disposal is never acceptable for treated wood?**
- a. Recycling
 - b. Disposal as hazardous waste
 - c. Burning
15. **Which federal agency regulates the management of mold?**
- a. EPA
 - b. OSHA
 - c. Department of Health and Human Services
 - d. CDC
 - e. None of the above
16. **Management and disposal of solid waste is regulated by which of the following?**
- a. Federal EPA
 - b. State EPA equivalent
 - c. County government
 - d. Municipal government
 - e. All of the above
17. **What is the legally binding document that governs the performance of a project to remove hazardous materials from buildings?**
- a. Universal Building Code
 - b. United States Codes
 - c. Occupational Safety and Health Act
 - d. The Contract
 - e. National Emissions Standards for Hazardous Air Pollutants
 - f. Toxic Substances Control Act
18. **The authority to make decisions regarding a contract's scope and/or compensation resides with whom?**
- a. Contractor's Project manager
 - b. Contracting Officer
 - c. Resident Engineer
 - d. Contracting Officer's representative
 - e. DPW Engineering Division Chief

- f. USACE District Engineering Division Chief
19. **The contract clauses for a contract to remove hazardous materials from an Army building are taken from which source?**
- a. Federal Register
 - b. Contract Law by Mark Roszkowski, Esq.
 - c. Uniform Commercial Code
 - d. Unified Facilities Criteria
 - e. Federal Acquisition Regulations
 - f. Engineer's Joint Contract Documents Committee
20. **You notice that the contractor, despite repeated warnings and directives, is still not placing hazardous materials in the appropriate containers and locked enclosures. What actions might the Contracting Officer take?**
- a. Issue a Stop Work Order
 - b. Withhold payment
 - c. Terminate the contract
 - d. All of the above
 - e. None of the above
21. **Which of the following will NOT be part of the contract close-out process?**
- a. Site clean-up
 - b. Verification that all deficiencies are corrected
 - c. Final inspection
 - d. Air quality certification
 - e. Final payment invoice
 - f. Contractor Quality Control Plan submittal and approval

Post-Test

Instructor's Notes

Copy this post-test separately and distribute to the class at the conclusion of the instruction.

1. **Certification is required by federal/state regulation prior to working with which substance(s)?**
 - a. Lead-based paint
 - b. Asbestos
 - c. PCBs
 - d. A and B
 - e. B and C
2. **Which of the following would NOT require the removal of hazardous waste from buildings?**
 - a. Encountering a hazardous material while repairing electrical equipment
 - b. Demolishing a WWII-era building
 - c. Demolishing a building constructed after 1979
 - d. Constructing a new building
 - e. Repurposing a building from one occupancy to another
3. **In relation to asbestos, the term “friable” is legally defined as which of the following:**
 - a. May be crumbled by hand pressure.
 - b. Flaking can be observed without specialized equipment.
 - c. The concentration of asbestos fibers in the air exceeds the OSHA PEL.
 - d. All of the above.
4. **Use of asbestos is completely banned in construction material today. (True or False)**
 - a. True
 - b. False
5. **What decades saw the most use of ACM in buildings?**
 - a. 1920s through 1970s
 - b. 1910s through 1980s
 - c. 1920s through 1960s

- d. 1890s through 1980s
- 6. **Friable asbestos must be removed from buildings prior to demolition in all cases. (True or False)**
 - a. True
 - b. False
- 7. **Which of the following Federal agencies regulate ACM removal projects?**
 - a. CDC , EPA, and OSHA
 - b. EPA and OSHA
 - c. EPA
 - d. HUD
- 8. **Who is required by regulation to receive notification prior to an ACM removal project?**
 - a. The Regional EPA Office of Federal Facilities Enforcement
 - b. County Department of Public Health
 - c. State environmental regulatory agency
 - d. Local fire department
- 9. **In the context of an ACM removal project, "clearance" is defined by regulation as which of the following?**
 - a. The visual inspection done by the Contracting Officer to ensure all areas stipulated in the contract have been removed.
 - b. Final payment for removal.
 - c. Receipt of disposal documentation for the removed ACM.
 - d. The air sampling required after cleanup to ensure there are no airborne fibers.
- 10. **Which Federal agency has responsibility for regulations to reduce exposure to the toxic effects of lead from lead-based paint?**
 - a. Occupational Safety and Health Administration
 - b. U.S. Department of Housing and Urban Development
 - c. Occupational Safety and Health Act
 - d. Environmental Protection Agency
 - e. Consumer Products Safety Commission
 - f. All of the above

11. **Which one of the following is NOT considered a lead-based paint hazard when present on a child-occupied facility?**
 - a. Lead-contaminated dust
 - b. Lead based paint on impact surfaces
 - c. Intact lead-based paint in good condition
 - d. Lead-based paint on friction surfaces of doors and windows in a housing unit
 - e. Lead-based paint on surfaces accessible to small children
 - f. Peeling and flaking lead-based paint

12. **Technical guidance to identify and control lead hazards from lead-contaminated paint dust, soil, or other sources in Army-owned or Army-leased target housing and child-occupied facilities constructed prior to 1978 is found in:**
 - a. UFGS 02 82 33.13 20, Removal/Control and Disposal of Paint with Lead
 - b. PWTB 420-70-2, Installation Lead Hazard Management
 - c. 40 CFR Part 745
 - d. 29 CFR Part 1926.62, Lead in Construction
 - e. Consumer Product Safety Improvement Act
 - f. All of the above

13. **Which is the most important factor in determining when to remove lead-based paint from the surfaces of an Army building?**
 - a. Lead contamination in dust on floors and window sills
 - b. Whether lead level exceeds 1.0 milligrams of lead per square centimeter
 - c. Condition of the paint
 - d. Age of the structure
 - e. Whether the building is classified as either target housing or a child-occupied facility
 - f. Breakdown of the paint due to UV exposure

14. The OSHA Lead in Construction Rule 29 CFR Part 1926.62 applies to all construction work:
 - a. Where lead is exposed in surface layers of paint
 - b. Where lead is present on friction and impact surfaces
 - c. Where lead-based paint is present, defined as lead greater than 1.0 mg/cm²

- d. Where lead levels exceed the CPSC limit of 0.009% by weight of a dry paint chip
 - e. Where lead-based paint is present, defined as lead greater than 0.5% by weight
 - f. Where an employee may be occupationally exposed to lead
- 15. In 1991 the Secretary of the Department of Health and Human Services called _____ the “number one environmental threat to the health of children in the United States.”**
- a. Asbestos
 - b. Treated lumber
 - c. Lead
 - d. PCBs
 - e. Mold
 - f. Silica
- 16. What year were PCBs banned from use in manufacturing of products in the United States?**
- a. 1962
 - b. 1975
 - c. 1986
 - d. 1979
 - e. 1959
- 17. What year was peak PCB production?**
- a. 1973
 - b. 1984
 - c. 1970
 - d. 1964
 - e. 1967
- 18. What was one brand name for PCBs?**
- a. Aroclor
 - b. HeatStop
 - c. Aranon
 - d. Chlorokane
- 19. In which if the following situations would PCBs NOT be found in buildings built prior to 1970?**
- a. Window caulking

- b. Light ballasts
 - c. Exterior paint
 - d. Flooring
- 20. What Federal law controls PCB management?**
- a. Clean Air Act
 - b. Toxic Substances Control Act
 - c. Resource Recovery and Conservation Act
 - d. Clean Water Act
 - e. Federal Insecticide, Fungicide, and Rodenticide Act
- 21. Why were PCBs added to common construction products?**
(Choose all that apply.)
- a. Color
 - b. Thermal stability
 - c. Odor
 - d. Elasticity
- 22. Property owners must survey their buildings for PCBs in construction products. (True or False)**
- a. True
 - b. False
- 23. Any PCBs found in building products must be removed. (True or False)**
- a. True
 - b. False
- 24. What agency is responsible for definitions of PCB-containing wastes and disposal requirements?**
- a. USACE
 - b. U.S. EPA
 - c. State environmental regulators
 - d. Local units of government
- 25. Which of the following is NOT a heavy metal?**
- a. Copper
 - b. Zinc
 - c. Stainless steel
 - d. Lead

- e. Mercury
- 26. Mercury-containing equipment or fluorescent lamps are classified as what?**
- a. Solid waste
 - b. Universal waste
 - c. Hazardous waste
 - d. Special waste
- 27. What is the primary constituent of concern in water-based preservatives used to treat wood?**
- a. Potassium
 - b. Arsenic
 - c. Petroleum
 - d. Selenium
- 28. Which of the following methods of disposal is never acceptable for treated wood?**
- a. Recycling
 - b. Disposal as hazardous waste
 - c. Burning
- 29. Which Federal agency regulates the management of mold?**
- a. EPA
 - b. OSHA
 - c. Department of Health and Human Services
 - d. CDC
 - e. None of the above
- 30. Which of the following is not a health concern related to mold?**
- a. Achiness
 - b. Skin irritation
 - c. Fungal infection
 - d. Respiratory distress
- 31. Management and disposal of solid waste is regulated by which of the following?**
- a. Federal EPA
 - b. State EPA equivalent

- c. County government
 - d. Municipal government
 - e. All of the above
- 32. Bulky wastes have to be disposed of within what length of time?**
- a. 6 months
 - b. 1 year
 - c. 3 months
 - d. 2 weeks
 - e. 1 month
- 33. What is the legally binding document that governs the performance of a project to remove hazardous materials from buildings?**
- a. Universal Building Code
 - b. United States Codes
 - c. Occupational Safety and Health Act
 - d. The Contract
 - e. National Emissions Standards for Hazardous Air Pollutants
 - f. Toxic Substances Control Act
- 34. The authority to make decisions regarding a contract's scope and/or compensation resides with whom?**
- a. Contractor's Project Manager
 - b. Contracting Officer
 - c. Resident Engineer
 - d. Contracting Officer's representative
 - e. DPW Engineering Division Chief
 - f. USACE District Engineering Division Chief
- 35. Which of the following most accurately describes a Scope of Work?**
- a. An instrument that detects hazardous materials in wall cavities.
 - b. The project site boundary, as defined by the chain link fence.
 - c. Means, methods, techniques, procedures, and sequences involved in performing the Work.
 - d. The estimated contract cost.
 - e. Tasks and activities to be performed as defined by the contract.
 - f. The technical specifications.

- 36. Which of the following tasks would NOT be within the responsibility of DPW or USACE environmental or engineering personnel involved with a remediation or abatement project?**
- a. Describe to the contractor how to correct deficiencies in their Work.
 - b. Compile asbestos survey data.
 - c. Edit guide specifications to represent the project at hand.
 - d. Advise the Contracting Officer on the appropriate technical evaluation factors for a Source Selection.
 - e. Support the DPW Quality Assurance Representative in technical issues.
 - f. Review the contractor's Safety Management Plan.
- 37. You are reviewing an asbestos survey to be included in a building demolition contract as Government Furnished Information. You notice the survey does not include the asbestos-containing pipe insulation that you know to be present, but which is hidden by ceilings. If the contract is awarded without correcting this survey, what effect on the contract's execution is the LEAST likely to occur?**
- a. The contractor may remove only the insulation identified in the asbestos survey.
 - b. The project could be delayed until a resolution is reached.
 - c. The project could incur additional cost for Work that was outside the contract scope.
 - d. The contractor could file a claim to recover the cost of performing out-of-scope work.
 - e. The contractor could demolish the building without abating the insulation, releasing asbestos fibers and incurring penalties.
 - f. The contractor will remove the additional insulation at their own expense.
- 38. The contract clauses to remove hazardous materials from an Army building are taken from which source?**
- a. Federal Register
 - b. Contract Law by Mark Roszkowski, Esq.
 - c. Uniform Commercial Code
 - d. Unified Facilities Criteria
 - e. Federal Acquisition Regulations
 - f. Engineer's Joint Contract Documents Committee

- 39. Which of the following should NOT be included in General Contract Requirements?**
- a. Amount of the performance bond required for the contract
 - b. Deadlines for beginning and completing the Work
 - c. Specifications for air filtration equipment
 - d. Authorized delays
 - e. Submittals requiring Government approval
 - f. Utility services available to the Contractor
- 40. In support of a USACE Quality Assurance Representative, you regularly visit the jobsite and observe whether the Work is conforming to the contract requirements. Which of the following would NOT be part of your observations?**
- a. Personal protective equipment is being worn as required.
 - b. Warning signs are posted on the jobsite perimeter.
 - c. Sufficient number of workers are on-site.
 - d. Hazardous materials are placed in the appropriate containers.
 - e. Quantities of hazardous materials removed from the site are verified.
 - f. Deficiencies are identified and corrected.
- 41. You notice the contractor, despite repeated warnings and directives, is still not placing hazardous materials in the appropriate containers and locked enclosures. What actions might the Contracting Officer take?**
- a. Issue a Stop Work Order
 - b. Withhold payment
 - c. Terminate the contract
 - d. All of the above
 - e. None of the above
- 42. Which of the following will NOT be part of the contract close-out process?**
- a. Site clean-up
 - b. Verification that all deficiencies are corrected
 - c. Final inspection
 - d. Air quality certification
 - e. Final payment invoice
 - f. Contractor Quality Control Plan submittal and approval

Post-Test with correct answers highlighted

1. **Certification is required by federal/state regulation prior to working with which substance(s)?**
 - a. Lead-based paint
 - b. Asbestos
 - c. PCBs
 - d. A and B
 - e. B and C
2. **Which of the following would NOT require the removal of hazardous waste from buildings?**
 - a. Encountering a hazardous material while repairing electrical equipment
 - b. Demolishing a WWII-era building
 - c. Demolishing a building constructed after 1979
 - d. Constructing a new building
 - e. Repurposing a building from one occupancy to another
3. **In relation to asbestos, the term “friable” is legally defined as which of the following:**
 - a. May be crumbled by hand pressure.
 - b. Flaking can be observed without specialized equipment.
 - c. The concentration of asbestos fibers in the air exceeds the OSHA PEL.
 - d. All of the above.
4. **Use of asbestos is completely banned in construction material today. (True or False)**
 - a. True
 - b. False
5. **What decades saw the most use of ACM in buildings?**
 - a. 1920s through 1970s
 - b. 1910s through 1980s
 - c. 1920s through 1960s
 - d. 1890s through 1980s
6. **Friable asbestos must be removed from buildings prior to demolition in all cases. (True or False)**

- a. True
 - b. False
7. **Which of the following Federal agencies regulate ACM removal projects?**
- a. CDC , EPA, and OSHA
 - b. EPA and OSHA
 - c. EPA
 - d. HUD
8. **Who is required by regulation to receive notification prior to an ACM removal project?**
- a. The Regional EPA Office of Federal Facilities Enforcement
 - b. County Department of Public Health
 - c. State environmental regulatory agency
 - d. Local fire department
9. **In the context of an ACM removal project, "clearance" is defined by regulation as which of the following?**
- a. The visual inspection done by the Contracting Officer to ensure all areas stipulated in the contract have been removed.
 - b. Final payment for removal.
 - c. Receipt of disposal documentation for the removed ACM.
 - d. The air sampling required after cleanup to ensure there are no airborne fibers.
10. **Which Federal agency has responsibility for regulations reduce exposure to the toxic effects of lead from lead-based paint?**
- a. Occupational Safety and Health Administration
 - b. U.S. Department of Housing and Urban Development
 - c. Occupational Safety and Health Act
 - d. Environmental Protection Agency
 - e. Consumer Products Safety Commission
 - f. All of the above
11. **Which one of the following is NOT considered a lead-based paint hazard when present on a child-occupied facility?**
- a. Lead-contaminated dust
 - b. Lead based paint on impact surfaces

- c. Intact lead-based paint in good condition
 - d. Lead-based paint on friction surfaces of doors and windows in a housing unit
 - e. Lead-based paint on surfaces accessible to small children
 - f. Peeling and flaking lead-based paint
12. **Technical guidance to identify and control lead hazards from lead-contaminated paint dust, soil, or other sources in Army-owned or Army-leased target housing and child-occupied facilities constructed prior to 1978 is found in:**
- a. UFGS 02 82 33.13 20, Removal/Control and Disposal of Paint with Lead
 - b. PWTB 420-70-2, Installation Lead Hazard Management
 - c. 40 CFR Part 745
 - d. 29 CFR Part 1926.62, Lead in Construction
 - e. Consumer Product Safety Improvement Act
 - f. All of the above
13. **Which is the most important factor in determining when to remove lead-based paint from the surfaces of an Army building?**
- a. Lead contamination in dust on floors and window sills
 - b. Whether lead level exceeds 1.0 milligrams of lead per square centimeter
 - c. Condition of the paint
 - d. Age of the structure
 - e. Whether the building is classified as either target housing or a child-occupied facility
 - f. Breakdown of the paint due to UV exposure
14. The OSHA Lead in Construction Rule 29 CFR Part 1926.62 applies to all construction work:
- a. Where lead is exposed in surface layers of paint
 - b. Where lead is present on friction and impact surfaces
 - c. Where lead-based paint is present, defined as lead greater than 1.0 mg/cm²
 - d. Where lead levels exceed the CPSC limit of 0.009% by weight of a dry paint chip
 - e. Where lead-based paint is present, defined as lead greater than 0.5% by weight

- f. Where an employee may be occupationally exposed to lead
15. In 1991 the Secretary of the Department of Health and Human Services called _____ the “number one environmental threat to the health of children in the United States.”
- a. Asbestos
 - b. Treated lumber
 - c. Lead
 - d. PCBs
 - e. Mold
 - f. Silica
16. What year were PCBs banned from use in manufacturing of products in the United States?
- a. 1962
 - b. 1975
 - c. 1986
 - d. 1979
 - e. 1959
17. What year was peak PCB production?
- a. 1973
 - b. 1984
 - c. 1970
 - d. 1964
 - e. 1967
18. What was one brand name for PCBs?
- a. Aroclor
 - b. HeatStop
 - c. Aranon
 - d. Chlorokane
19. In which if the following situations would PCBs NOT be found in buildings built prior to 1970?
- a. Window caulking
 - b. Light ballasts
 - c. Exterior paint
 - d. Flooring

20. **What Federal law controls PCB management?**
- a. Clean Air Act
 - b. Toxic Substances Control Act
 - c. Resource Recovery and Conservation Act
 - d. Clean Water Act
 - e. Federal Insecticide, Fungicide, and Rodenticide Act
21. **Why were PCBs added to common construction products?**
(Choose all that apply.)
- a. Color
 - b. Thermal stability
 - c. Odor
 - d. Elasticity
22. **Property owners must survey their buildings for PCBs in construction products. (True or False)**
- a. True
 - b. False
23. **Any PCBs found in building products must be removed. (True or False)**
- a. True
 - b. False
24. **What agency is responsible for definitions of PCB-containing wastes and disposal requirements?**
- a. USACE
 - b. U.S. EPA
 - c. State environmental regulators
 - d. Local units of government
25. **Which of the following is NOT a heavy metal?**
- a. Copper
 - b. Zinc
 - c. Stainless steel
 - d. Lead
 - e. Mercury
26. **Mercury-containing equipment or fluorescent lamps are classified as what?**

- a. Solid waste
 - b. Universal waste**
 - c. Hazardous waste
 - d. Special waste
- 27. What is the primary constituent of concern in water-based preservatives used to treat wood?**
- a. Potassium
 - b. Arsenic**
 - c. Petroleum
 - d. Selenium
- 28. Which of the following methods of disposal is never acceptable for treated wood?**
- a. Recycling
 - b. Disposal as hazardous waste
 - c. Burning**
- 29. Which Federal agency regulates the management of mold?**
- a. EPA
 - b. OSHA
 - c. Department of Health and Human Services
 - d. CDC
 - e. None of the above**
- 30. Which of the following is not a health concern related to mold?**
- a. Achiness**
 - b. Skin irritation
 - c. Fungal infection
 - d. Respiratory distress
- 31. Management and disposal of solid waste is regulated by which of the following?**
- a. Federal EPA
 - b. State EPA equivalent
 - c. County government
 - d. Municipal government
 - e. All of the above**

32. **Bulky wastes have to be disposed of within what length of time?**
- a. 6 months
 - b. 1 year
 - c. 3 months
 - d. 2 weeks
 - e. 1 month
33. **What is the legally binding document that governs the performance of a project to remove hazardous materials from buildings?**
- a. Universal Building Code
 - b. United States Codes
 - c. Occupational Safety and Health Act
 - d. The Contract
 - e. National Emissions Standards for Hazardous Air Pollutants
 - f. Toxic Substances Control Act
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 - e. None of the above
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- a. Site clean-up
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Evaluation Form

Please complete the following course evaluation form and turn it in to the instructors before leaving the class. Your feedback is essential to help identify needed course improvements and upgrade the course for future applications. Thank you for your participation and input.

Class title and location:

Name (optional):

Station location and job title (optional):

Please indicate whether you agree or disagree with the following statements by selecting a number 1 (Strongly Disagree) through 5 (Strongly Agree). If the statement is not applicable, indicate "NA."

1. Instructors

a. Were well organized	1	2	3	4	5	NA
b. Were well versed in their subject matter	1	2	3	4	5	NA
c. Performed a review of each subject	1	2	3	4	5	NA
d. Encouraged student participation	1	2	3	4	5	NA
e. Demonstrated effective platform skills	1	2	3	4	5	NA

2. Learning Objectives

a. Were identified for each subject	1	2	3	4	5	NA
b. Were job related	1	2	3	4	5	NA
c. Were thoroughly covered	1	2	3	4	5	NA

3. Course Content

a. Was presented in a logical sequence	1	2	3	4	5	NA
b. Subjects were job-related	1	2	3	4	5	NA
c. Course was a reasonable length	1	2	3	4	5	NA

- | | | | | | | |
|--|---|---|---|---|---|----|
| 4. Course Manual | | | | | | |
| a. Was well organized | 1 | 2 | 3 | 4 | 5 | NA |
| b. Was legible | 1 | 2 | 3 | 4 | 5 | NA |
| c. Was used during instruction | 1 | 2 | 3 | 4 | 5 | NA |
| d. Will be used as a reference on the job | 1 | 2 | 3 | 4 | 5 | NA |
| 5. Visual Aids | | | | | | |
| a. Were relevant to the learning objectives | 1 | 2 | 3 | 4 | 5 | NA |
| b. Enhanced the instruction | 1 | 2 | 3 | 4 | 5 | NA |
| c. Were good quality (readable/accurate) | 1 | 2 | 3 | 4 | 5 | NA |
| 6. Exams | | | | | | |
| a. Test items related to the learning objectives | 1 | 2 | 3 | 4 | 5 | NA |
| b. Test items were easily understood | 1 | 2 | 3 | 4 | 5 | NA |
| 7. Overall Reaction | | | | | | |
| a. Course expectations were met | 1 | 2 | 3 | 4 | 5 | NA |
| b. Would recommend course to others | 1 | 2 | 3 | 4 | 5 | NA |
| c. Contributed to my knowledge and skills | 1 | 2 | 3 | 4 | 5 | NA |

What subjects should be improved or added to enhance your job performance?

What subjects should be deleted or de-emphasized?

What subjects were most beneficial?

General comments; venue, instructors, other (use other side if necessary):

Appendix C: Certificate of Completion

Office of the Assistant Chief of Staff, Installations Management	
	
<i>CERTIFICATE</i>	
<i>has successfully completed the OACSIM course</i>	
Removing Hazardous Materials from Buildings	
Given at	_____
<i>Location</i>	<i>Date</i>

<i>Instructors</i>	

Appendix D: Student Handouts

Support and contacts

The *Removing Hazardous Materials from Buildings* workshop was funded by the Office of the Assistant Chief of Staff for Installation Management, Facilities Policy Division (OACSIM-ODF) to support OACSIM and the Army in matters regarding hazardous building materials and the provision of ongoing training. Managing the Army's Hazardous Building Materials program and policy is one of the OACSIM-ODF major functions. The workshop curriculum and materials were developed by the U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory in Champaign IL.

Syllabus

Course Objective: The objective of this course is to provide a workshop-style training curriculum which will enable installation operations and management personnel to identify, handle and dispose of Hazardous Building Materials in a safe, thorough, efficient and economical manner. Doing so will support the OACSIM in matters regarding Hazardous Building Materials and provision of ongoing training.

Intended Audience: This course is directed toward an Army installation's Directorate of Public Works (DPW) personnel, typically in the Environmental Division. Personnel will be involved with surveying, recording, and controlling hazardous materials in buildings. They may also support Engineering Division and other DPW offices in performing building removal or repurposing tasks. This class will be equally applicable to U.S. Army Corps of Engineers (USACE) District personnel supporting the installation with Sustainment, Restoration, and Modernization (SRM) construction-type activities, or those executing military construction (MILCON) projects.

Course Format: This course will be delivered in a workshop setting. Presentations will be made, and discussions will be encouraged. Interaction between the instructors and the class will be critical. A Pre-Test will be given prior to the presentations to assess students' level of knowledge in the subject. A Post-Test will be given at the end of the class to assess how

successfully students learned the material presented in the course. “Quiz Time!” game-show session will also be included as a diversion from the classroom routine.

Course Content: The course will address materials defined as hazardous to the environment and/or human health and other materials that are problematic from a health, removal, and disposal perspective. As an installation will almost always contract for services to remove hazardous waste from buildings, a section on contracting is also included. The focus of this course is removing hazardous building materials when demolishing buildings or when repurposing or converting buildings to a new function or occupancy. Some regulated materials may also be incorporated into new construction, and these are also addressed.

The course includes the following topics:

- Course Introduction
- Class Introduction
- OACSIM Public Works Technical Bulletin (PWTB) Toxics Management
- Asbestos
- Lead-Based Paint (LBP)
- Polychlorinated Biphenyls (PCBs)
- Silica
- Treated Lumber
- Mold
- Miscellaneous Waste
- Solid Waste Management
- Contracting
- Course Evaluation

For consistency in the type of information and level of detail presented for each hazardous building material, the following will be discussed within each section, as applicable:

- Terminology
- History of use
- Use by the Army
- Health issues
- Regulation
- Demolition and building repurposing concerns

- Detection
- Management and disposal

Course Completion: At the conclusion of this course, each student will be able to:

- Identify hazardous building materials
- Identify applicable laws, regulations, and standards
- Describe practices, tasks, and control measures involved in removing hazardous building materials
- Be familiar with the contents and applications of contracts to remove hazardous building materials

Successful completion of this course will require the student to be attentive to the instructors and class materials; contribute their questions, experiences and observations to class discussions; successfully complete the post-test; and complete a course evaluation.

Points of Contact:

Instructor: *[Info to be added for each class.]*

OACSIM: Liisa White
OACSIM-ODF
liisa.m.white.civ@mail.mil
571-256-9775

Instructor Biographies

Instructor: *[Info & photo to be added for each class.]*



Photograph

Schedule

Day 1: Morning

- Instructor Introduction
- Course Description
- Class Introduction; students' backgrounds, job descriptions, interests, and expectations for the workshop
- Pre-test
- OACSIM Public Works Technical Bulletin (PWTB) 200-1-144, "Toxics Management"

Day 1: Afternoon

- Asbestos
- Lead-Based Paint (LBP)

Day 2: Morning

- Polychlorinated Biphenyls (PCBs)
- Silica
- Treated Lumber
- Mold
- Miscellaneous Waste
- Solid Waste Management

Day 2: Afternoon

- •Contracting
- Exercise: Hazardous Material Quiz Time!
- Post-test
- Course evaluation
- Wrap-up

Pre-Test

1. **Which of the following would NOT require the removal of hazardous waste from buildings?**
 - a. Encountering a hazardous material while repairing electrical equipment
 - b. Demolishing a WWII-era building

- c. Demolishing a building constructed after 1979
 - d. Constructing a new building
 - e. Repurposing a building from one occupancy to another
2. **Use of asbestos is completely banned in construction material today. (True or False)**
- a. True
 - b. False
3. **Friable asbestos must be removed from buildings prior to demolition in all cases. (True or False)**
- a. True
 - b. False
4. **Which of the following federal agencies regulate ACM removal projects?**
- a. CDC , EPA, and OSHA
 - b. EPA and OSHA
 - c. EPA
 - d. HUD
5. **Who is required by regulation to receive notification prior to an ACM removal project?**
- a. The Regional EPA Office of Federal Facilities Enforcement
 - b. County Department of Public Health
 - c. State environmental regulatory agency
 - d. Local fire department
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- a. Occupational Safety and Health Administration
 - b. U.S. Department of Housing and Urban Development
 - c. Occupational Safety and Health Act
 - d. Environmental Protection Agency
 - e. Consumer Products Safety Commission
 - f. All of the above

7. **Which is the most important factor in determining when to remove lead-based paint from the surfaces of an Army building?**
 - a. Lead contamination in dust on floors and window sills
 - b. Whether lead level exceeds 1.0 milligrams of lead per square centimeter
 - c. Condition of the paint
 - d. Age of the structure
 - e. Whether the building is classified as either target housing or a child-occupied facility
 - f. Breakdown of the paint due to UV exposure
8. **In 1991 the Secretary of the Department of Health and Human Services called _____ the “number one environmental threat to the health of children in the United States.”**
 - a. Asbestos
 - b. Treated lumber
 - c. Mold
 - d. PCBs
 - e. Lead
9. **What federal law controls PCB management?**
 - a. Clean Air Act
 - b. Toxic Substances Control Act
 - c. Resource Recovery and Conservation Act
 - d. Clean Water Act
 - e. Federal Insecticide, Fungicide, and Rodenticide Act
10. **Why were PCBs added to common construction products?**
(Select all that apply.)
 - a. Color
 - b. Thermal stability
 - c. Odor
 - d. Elasticity
11. **Any PCBs found in building products must be removed.** *(True or False)*
 - a. True
 - b. False

- 12. What agency is responsible for definitions of PCB-containing wastes and disposal requirements?**
 - a. USACE
 - b. U.S. EPA
 - c. State environmental regulators
 - d. Local units of government
- 13. Mercury-containing equipment or fluorescent lamps are classified as what?**
 - a. Solid waste
 - b. Universal waste
 - c. Hazardous waste
 - d. Special waste
- 14. Which of the following methods of disposal is never acceptable for treated wood?**
 - a. Recycling
 - b. Disposal as hazardous waste
 - c. Burning
- 15. Which Federal agency regulates the management of mold?**
 - a. EPA
 - b. OSHA
 - c. Department of Health and Human Services
 - d. CDC
 - e. None of the above
- 16. Management and disposal of solid waste is regulated by which of the following?**
 - a. Federal EPA
 - b. State EPA equivalent
 - c. County government
 - d. Municipal government
 - e. All of the above
- 17. What is the legally binding document that governs the performance of a project to remove hazardous materials from buildings?**
 - a. Universal Building Code
 - b. United States Codes

- c. Occupational Safety and Health Act
 - d. The Contract
 - e. National Emissions Standards for Hazardous Air Pollutants
 - f. Toxic Substances Control Act
- 18. The authority to make decisions regarding a contract's scope and/or compensation resides with whom?**
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 - c. Uniform Commercial Code
 - d. Unified Facilities Criteria
 - e. Federal Acquisition Regulations
 - f. Engineer's Joint Contract Documents Committee
- 20. You notice that the contractor, despite repeated warnings and directives, is still not placing hazardous materials in the appropriate containers and locked enclosures. What actions might the Contracting Officer take?**
- a. Issue a Stop Work Order
 - b. Withhold payment
 - c. Terminate the contract
 - d. All of the above
 - e. None of the above
- 21. Which of the following will NOT be part of the contract close-out process?**
- a. Site clean-up
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Class title and location:

Name (optional):

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Please indicate whether you agree or disagree with the following statements by selecting a number 1 (Strongly Disagree) through 5 (Strongly Agree). If the statement is not applicable, indicate "NA."

22. Instructors

- | | | | | | | |
|---|---|---|---|---|---|----|
| a. Were well organized | 1 | 2 | 3 | 4 | 5 | NA |
| b. Were well versed in their subject matter | 1 | 2 | 3 | 4 | 5 | NA |
| c. Performed a review of each subject | 1 | 2 | 3 | 4 | 5 | NA |
| d. Encouraged student participation | 1 | 2 | 3 | 4 | 5 | NA |
| e. Demonstrated effective platform skills | 1 | 2 | 3 | 4 | 5 | NA |

23. Learning Objectives

- | | | | | | | |
|-------------------------------------|---|---|---|---|---|----|
| a. Were identified for each subject | 1 | 2 | 3 | 4 | 5 | NA |
| b. Were job related | 1 | 2 | 3 | 4 | 5 | NA |
| c. Were thoroughly covered | 1 | 2 | 3 | 4 | 5 | NA |

24. Course Content

- | | | | | | | |
|--|---|---|---|---|---|----|
| a. Was presented in a logical sequence | 1 | 2 | 3 | 4 | 5 | NA |
|--|---|---|---|---|---|----|

b. Subjects were job-related	1	2	3	4	5	NA
c. Course was a reasonable length	1	2	3	4	5	NA
25. Course Manual						
a. Was well organized	1	2	3	4	5	NA
b. Was legible	1	2	3	4	5	NA
c. Was used during instruction	1	2	3	4	5	NA
d. Will be used as a reference on the job	1	2	3	4	5	NA
26. Visual Aids						
a. Were relevant to the learning objectives	1	2	3	4	5	NA
b. Enhanced the instruction	1	2	3	4	5	NA
c. Were good quality (readable/accurate)	1	2	3	4	5	NA
27. Exams						
a. Test items related to the learning objectives	1	2	3	4	5	NA
b. Test items were easily understood	1	2	3	4	5	NA
28. Overall Reaction						
a. Course expectations were met	1	2	3	4	5	NA
b. Would recommend course to others	1	2	3	4	5	NA
c. Contributed to my knowledge and skills	1	2	3	4	5	NA

What subjects should be improved or added to enhance your job performance?

What subjects should be deleted or de-emphasized?

What subjects were most beneficial?

General comments; venue, instructors, other (use other side if necessary):

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NOTES:

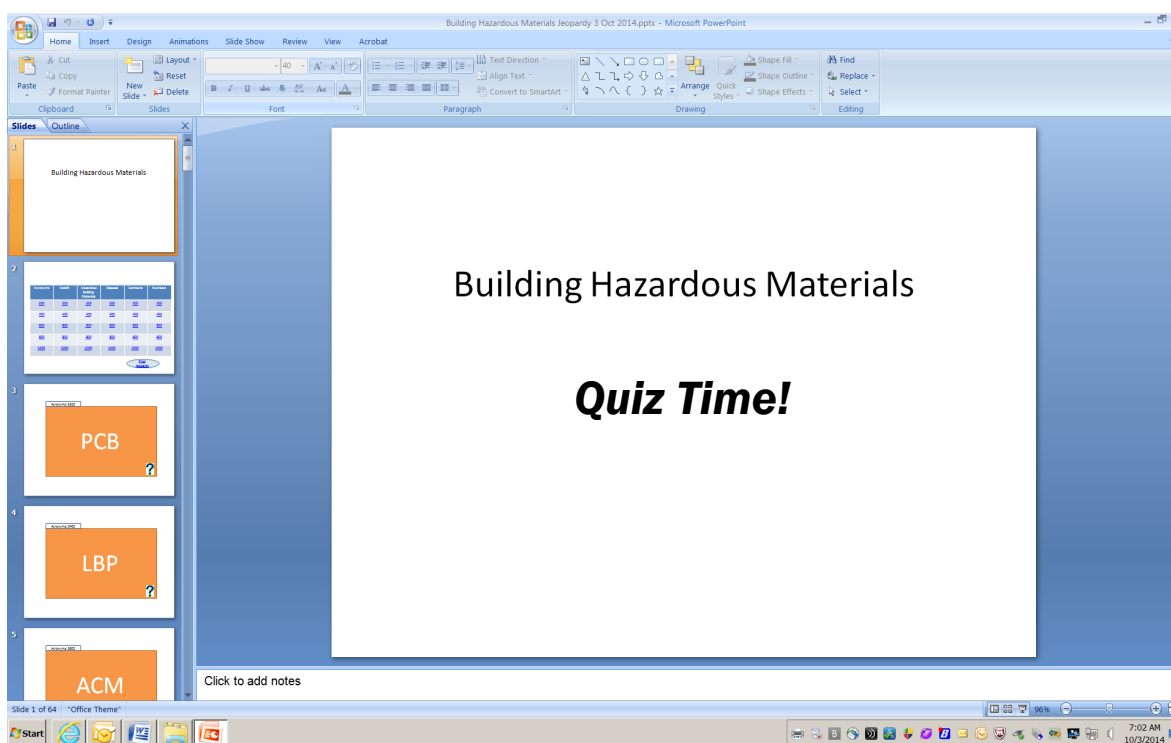
The following slide numbers are subject to change.

Presentation slides will be distributed via electronic media.

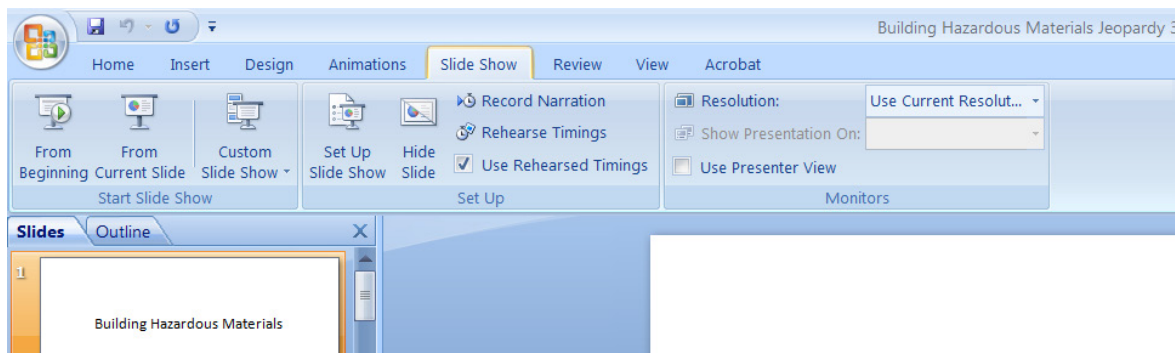
Section Title	Starting Slide Number
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EXERCISE: HAZARDOUS MATERIAL QUIZ TIME!	Separate File

Appendix E: Using the “Building Hazardous Materials Quiz Time!” PowerPoint file

Step 1: Open the .pptx file as provided. It will look like this:



Step 2: Select the “Slide Show” tab at the top of the screen. Then select “From Beginning.”



The result will be the following screen:

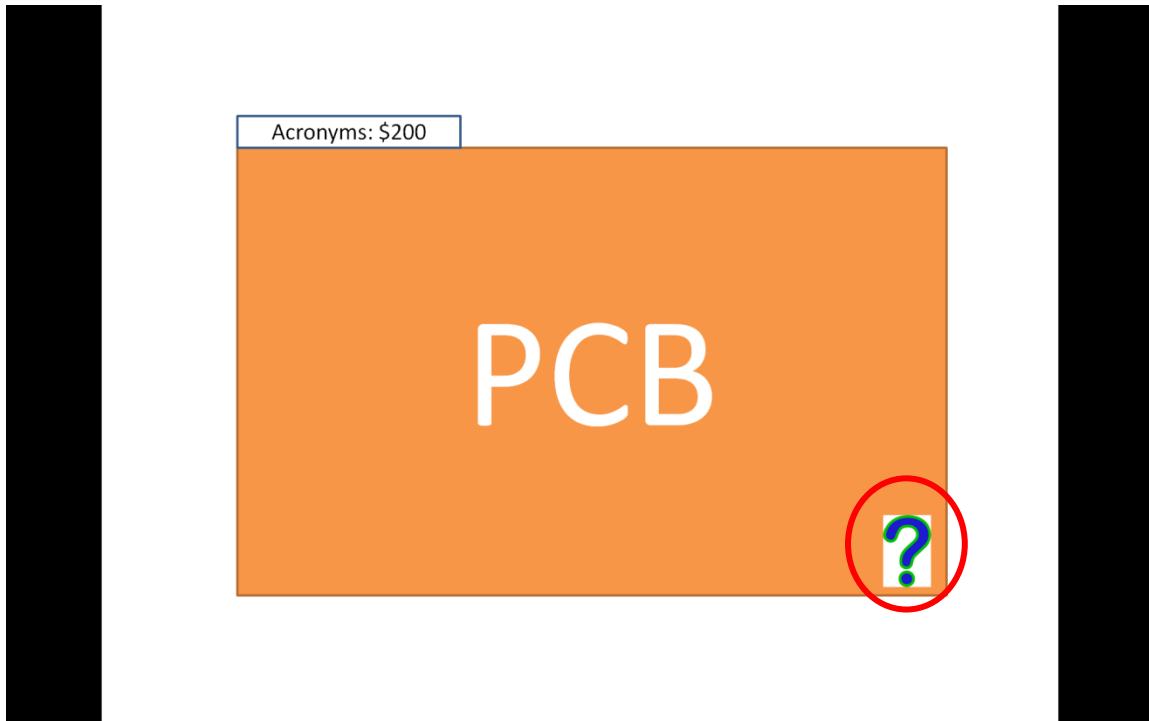
Building Hazardous Materials

Quiz Time!

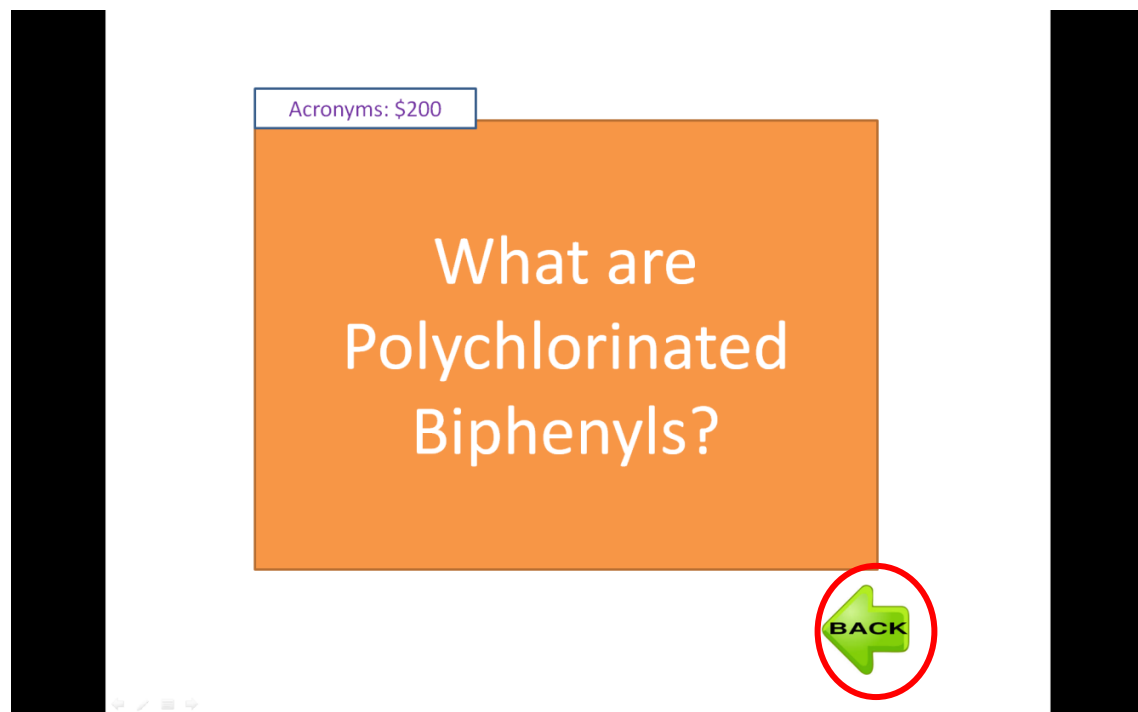
Step 3: Page down one screen. When the player selects a category and a dollar amount, click on that link. For purposes of this example, use “Acronyms for \$200.”

Acronyms	Health	Hazardous Building Materials	Disposal	Contracts	Numbers
200	200	200	200	200	200
400	400	400	400	400	400
600	600	600	600	600	600
800	800	800	800	800	800
1000	1000	1000	1000	1000	1000

Step 4: The clue will appear. After the player answers the question, click on the question mark.



Step 5: The answer will display. To go back to the main menu, click on the “Back” button.



Step 6. Notice that the clue which was already selected will have changed color so that you know it is no longer in play.

Acronyms	Health	Hazardous Building Materials	Disposal	Contracts	Numbers
<u>200</u>	<u>200</u>	<u>200</u>	<u>200</u>	<u>200</u>	<u>200</u>
<u>400</u>	<u>400</u>	<u>400</u>	<u>400</u>	<u>400</u>	<u>400</u>
<u>600</u>	<u>600</u>	<u>600</u>	<u>600</u>	<u>600</u>	<u>600</u>
<u>800</u>	<u>800</u>	<u>800</u>	<u>800</u>	<u>800</u>	<u>800</u>
<u>1000</u>	<u>1000</u>	<u>1000</u>	<u>1000</u>	<u>1000</u>	<u>1000</u>

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14. ABSTRACT There has been little or no formalized training available within the Army for installation personnel to appropriately identify, handle, and dispose of hazardous materials generated during the renovation and/or demolition of Army buildings. As the Army's new construction programs wind down, attention must be paid to operation, repair, and renovation of existing facilities—where hazardous materials are more likely to be encountered. An ad hoc, reactive approach to dealing with hazardous materials will adversely impact repair, renovation, and operation budgets and schedules while increasing the likelihood of regulatory noncompliance. Development of a training regimen was previously deferred but is now being addressed. Per direction from the Office of the Assistant Chief of Staff for Installation Management Facility Policy Division (DAIM-ODF), a Public Works Technical Bulletin, "Toxics Management," was completed in 2014 and published through Headquarters, U.S. Army Corps of Engineers. That publication provides guidance to address specific toxic and hazardous materials associated with buildings that are owned, leased, or otherwise controlled by the Department of the Army. For additional training documentation, this report captures a workshop-style training curriculum developed to enable installation operations and management personnel to identify, handle, and dispose of hazardous building materials in a safe, thorough, efficient, compliant, and economical manner.					
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